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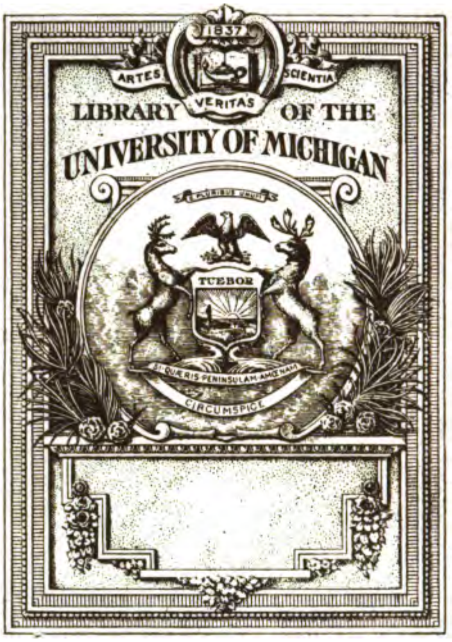
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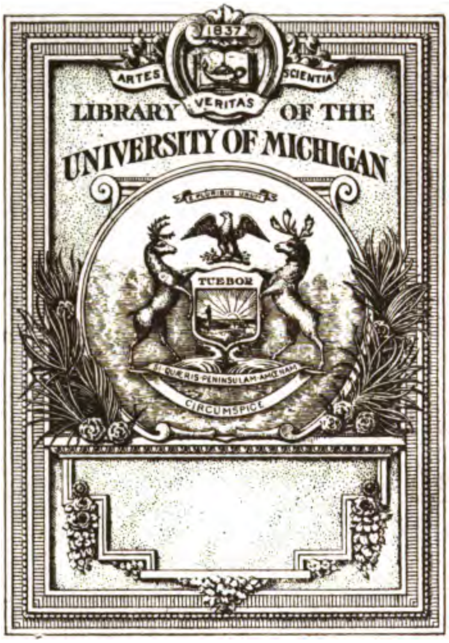
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A MANUAL ON

THE RULE OF THE ROAD AT SEA

AND

PRECAUTIONARY AIDS TO MARINERS

BY

DANIEL H.arvey HAYNE

of the Baltimore Bar

Un

SECOND EDITION

Revised and Enlarged

Baltimore, Md.
The Co-operative Publishing Co.
1912

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TO

MICHAEL JENKINS,

THE MARINERS' FRIEND, WHOSE WISE PRECEPT
AND UPRIGHT EXAMPLE HAVE AIDED AND ENCOURAGED THE
WRITER, THIS LITTLE WORK IS GRATEFULLY
INSCRIBED.

319541

FOREWORD TO SECOND EDITION.

This manual was issued in 1897 for private distribution. It was kindly received and, at the request of those who have used it in practical application, this edition has been issued.

The fullness of this foreword will make the succeeding subjects clearer.

There is no intention to venture upon the broad sea of navigation. This has been well presented in such works as *"Practical Seamanship," by John Todd and W. B. Whall; "Know Your Own Ship," by Walton; "Bedford's Sailors' Pocket Book;" "Raper's Practice of Navigation;" "Practical Methods in Modern Navigation," by Comte de Miremont; "Wrinkles in Practical Navigation" and "General Utility Tables" and "The Danger Angle and Off-Shore Distance Tables," by S. T. S. Lecky, Master Mariner; the invaluable works of Sir William Thompson (Lord Kelvin); "American Practical Navigator," by Nathaniel Bowditch; "Gill's Text Book on Navigation and Nautical Astronomy;" "Navigation and Nautical Astronomy and the Theory of Compass Deviations," by Commander W. C. P. Muir, U. S. N.; "Modern Seamanship," by Captain Austin M. Knight, U. S. N., and others.*

Those who incline to a deeper familiarity with navigation and admiralty, in all branches, will find a full bibliography on pages 135–147.

It is impossible to divest the subject of technicality, for the rules are set in a certain professional and legal atmosphere that is inseparable from them. We may try to shorten the explanation and simplify the principles, but we cannot avoid the difficulty nor shirk the problems. Where the text does not undertake to offer detail explanation, reference is made to the works in which the subject is fully explained.

Writing of other complicated branches of navigation with a comprehensiveness born of an analysis as true as the needle to the pole, *Lord Kelvin* recognized the great difficulty in presenting this subject, in these words:

> "But there is a danger affecting navigation in all weathers, though with greatest intensity in fogs, which no degree of human skill and conscientiousness can reduce to absolute zero, and that is ***collision.***"

The most prolific source of marine danger is ***collision.*** Scarcely a day passes without report of such a disaster, involving loss of life or destruction of property.

Here ***marine collision*** is the theme, co-ordinated with its related subjects, and treated from a new point of view. Stated in nautical language: Lights are set at old danger points, and some new buoys mark a safe way around. It is assumed that those taking an interest in the subject are familiar with elementary marine conditions, the nomenclature of the sea, and the parts and equipment of the ship.

The entire subject has been reviewed. Notes, derived from the writer's actual observation on shipboard and in litigation during the past twenty-five years, have been tested in practical application and utilized, in order to select and condense the leading precautionary aids relating to collision with as much brevity as clear statement will permit; and effort will be made to systematize and bring under their proper headings the most important practical and judicial aids applied by skilful mariners, and adopted by the courts.

These aids deal mostly with the attitude of the navigator toward the rules and the practice of good seamanship, and are, therefore, primarily aids toward safe conduct. ***They are not intended to conflict with or to supplant, but rather to explain,*** the rules in an endeavor to secure ***prompt*** and ***uniform*** application of them.

No effort is made to re-state or to affect, in the slightest degree, any of the statute rules. The rules themselves may be obtained by application to the respective governmental departments shown in Note opposite page 1; ***they should first be carefully read and understood as a means of comprehending these aids.***

All precautionary aids apply alike to international, coast, and inland waters, and to the great inland waterways. Without their application the rules themselves are deprived of their effectiveness. ***The rules are silent on a great many essential points which must be known and applied to effectually obey them.***

The problems here considered are arising daily on shipboard and, in many instances, are being well met by the resourcefulness of navigators; but one of the main dangers is that they are frequently being solved in ***different*** ways.

One of the chief requisites towards a clear understanding of what the other vessel will do in conformance to the rule then applying, is ***prompt uniformity*** (by both vessels) in the method of its application, and freedom from individual caprice. Nowhere is this principle so vitally involved as in the application of the rules to avoid collision. ***Uniform*** and ***prompt*** application of the rules is of first importance, in order that A may anticipate what B will do from B's point of view, and vice versa.

In correctly anticipating what the other vessel will do lies the efficiency of the resourceful and cautious navigator. Experience applied with caution develops this faculty until it becomes apparently intuitive.

PART 1 refers briefly to practical precautions relating to the rules of the road, and to certain well considered court-made rules, defining good seamanship, which are applied as rigidly as the navigation rules. These judicial rules are not published in convenient form for the use of mariners, and are to be found only in the court records and in law reports and publications.

Nor is it always safe to attempt to distinguish between sound and unsound decisions. When the court's error is clearly opposed to safe navigation the rule of special circumstance applies, for no experienced navigator would be expected to comply with either rules or suggestions when they tend toward uncertainty and disaster.

The wisdom of the safe and prudent rulings is often first learned in a personal experience through the courts, at great expense to owners, frequently after lamentable personal injury or loss of life and property, and loss of reputation to the navigators themselves. *We have space to state only the principal points in apt language.*

Throughout Part 1 *great stress* is laid on (a) the *willingness* of the navigator to comply with the rules, and (b) the *prompt* and *uniform* application of them.

PART 2 presents some of the more practical elements in ship conduct and discipline, and precautions in handling the vessel and its equipment, to which prudent navigators have attached much importance, and to which they owe their immunity from accident.

Whatever may be said of the rules of the road and the insistence on the part of owners and courts that they shall be *promptly* applied, the great mass of threatened collisions are, in fact, foreseen and prevented by skilful attention of commanding officers.

After twenty-five years' experience in daily contact with those following the sea, both on the practical and theoretical side, and frequently in a direct personal observation in the pilot house during navigation, and a long experience in admiralty litigation, the writer bears witness that they are possessed of an honesty of purpose and a courage which is not excelled by any other class of citizens; and that their loyal attention to duty is shown in the personal dangers they accept and the very few collisions that happen in comparison with the instances that are avoided.

The mariner's acceptance of the marine risk has, according to the calculation of Dr. J. F. Caswell, given to the world an annual traffic valued at over $25,000,000,000.

Conditions on shipboard require a character of discipline which sometimes develops an apparently gruff disposition, but in moments of danger those upon whom duty rests may be relied upon to fully measure up to exacting requirements, which frequently call for their own exposure to danger in the effort to protect others. Their calling is an essentially heroic one, and requires a spiritual courage which dares and does, without the stimulating applause which is often the incentive to mere physical courage.

Besides, it must be remembered that the navigator's calling requires great scientific learning in the very highest branches of human knowledge, combined with judgment and training as rare as is required in any walk of life. They are justly entitled to great respect, and forbearance should be exercised in weighing all the surrounding circumstances (and *all* surrounding conditions should be weighed) before they are condemned in a given instance.

The great majority of those following the sea are thoughtful, intelligent men, and to these, and to candidates looking to advancement with attending responsibilities, these aids are presented.

Each individual may, in his particular field of activity, do much in adding to, instead of subtracting from, the world's storehouse. Nowhere can sincere co-operation accomplish more than in the honored calling of navigation, for nowhere can a very slight neglect lead to more serious consequences, spreading desolation and gloom in its wake. If this manual but directs attention to the necessity for ***a thorough understanding of,*** and for a ***prompt*** and ***uniform compliance with, the rules designed to prevent collision,*** its object will have been attained.

The writer has been fortunate in securing the valued aid of *Robert M. Hughes,* Norfolk, Va.; *Frank Healy,* Providence, R. I.; *Joseph A. O'Brien* and *J. A. Guthrie, Jr.,* Philadelphia, Pa.; *M. V. O'Neal, T. H. Swank,* and *J. M. Blankenship,* Baltimore, Md.; and *Captains Miles Hillary, Benjamin T. Haagenson, T. P. Pratt, J. B. Wood, J. Johnson, W. J. Bond,* and *F. M. Howes,* in critical review of certain parts of the advance copy.

Appreciative acknowledgment is due *R. H. Newbern, Superintendent, Insurance Department, Pennsylvania Railroad,* and *J. C. Whitney, President, Merchants and Miners Transportation Company.* They and their respective marine departments have given the writer much encouragement and assistance in the preparation of this manual.

Acknowledgment of valued advice and suggestion is also due *Hon. Addison Brown, formerly judge of the District Court of the United States for the Southern District of New York,* whose decisions in the admiralty have illumined the way to a clearer understanding of the rules designed to prevent marine collisions.

Precautionary Aids, in Parts 1 and 2, have been drawn from so many sources, covering such a long period, that it would be impossible to remember and give credit to all who have contributed thereto. Opportunity is here taken to express appreciation to friends in the nautical profession, and to others, for their aid and suggestion.

Criticism and suggestion are cordially invited from anyone taking an interest in the subject for, as Emerson aptly says, "Every man I meet is my master in some good point, and in that I should learn of him."

D. H. H.

Baltimore, Md., April 15, 1912.

PREFACE TO FIRST EDITION.

Although to the experienced and prudent navigator the rules of the road are familiar, it not infrequently occurs that a new judicial rule (not contained in the collision rules but dictated by sound seamanship) is applied by the court after a collision has occurred, holding his vessel solely or partly liable for a collision, when the particular requirement has thus, for the first time, come to his attention.

Here there is space to refer only to the most important and well considered judicial rules which have become interlaced with the statute rules. They are not to be regarded as peremptory rules to be obeyed in every emergency; they are subject to the rule of special circumstances and should only be adopted when their use would avoid collision or the ***risk*** of collision.

Safe precautionary aids have no geographical limitations. They apply to all waters and to all classes of vessels. They are in no instance to be allowed to interfere with the rules adopted by the Government—they relate to them, but in no wise conflict with or supplant them.

Precautionary aids (like the rules) are applicable to steam vessels, that is, to STEAMSHIPS, STEAMBOATS, FERRY BOATS, PILOT BOATS, TUGS, TUGS AND TOWS, MOTOR BOATS, in fact, to all vessels propelled by machinery, or by machinery and sail combined (known as steam vessels); to SAILING VESSELS, and, under some conditions, to VESSELS PROPELLED BY HAND POWER AND CURRENT.

As a precaution, it should be added that nothing must be allowed to interfere with steadfast adherence to the rules requiring the "burdened" vessel to keep out of the

way, and the "privileged" vessel to hold its course and speed, except where a departure from the rules may be justified.

It is confidently suggested that the prompt application of the rules of the road, under the precautions suggested herein, will minimize the requirement to risk close, tactical, and often futile maneuvers, in the "jaw" of the danger.

D. H. H.

Baltimore, Md., December 10, 1897.

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NOTE.

THE RULES OF THE ROAD.

The rules of the particular locality traversed by the vessel must be carefully studied to understand PRECAUTIONARY AIDS.

The Federal and local rules are subject to change. To keep properly advised, it is safer to make periodic request for information from the authorities issuing the rules and notices affecting them.

If the name and address is sent to the following authorities, it will be placed on the permanent mailing lists for the regular circulars and notices, bulletins, etc.

The Rules of the Road should be carefully studied, and these suggestions should be applied only as aids, when they are not in conflict with the rules, regulations, and instructions issued under Governmental authority, except when a departure from the rule is the only method to avoid collision (but see Departure from the Rules, page 40.)

THE LOCALITIES, SUBJECTS, AND AUTHORITY.

The **BUREAU OF NAVIGATION,** Washington, D. C., furnishes the statute rules, and prescribes regulations relating to the **high seas** (International rules); the **Atlantic and Pacific Coast waters and tributaries, and the Gulf of Mexico Coast waters** (Inland rules); the **Great Lakes, and connecting and tributary waters as far east as Montreal;** special rules and regulations for motor boats; for seagoing tow lines; for regattas and marine parades; for the St. Mary's River; and for anchorage grounds in the harbors of New York and Chicago and other special subjects taken up particularly. Bills are pending before Congress designed to cover other anchorage grounds.

The **STEAMBOAT INSPECTION SERVICE,** Washington, D. C., prescribes and furnishes **pilot rules** and regulations for the above localities, and for the **Red River of the**

North, and rivers flowing into the Gulf of Mexico, and their tributaries.

The **SECRETARY OF WAR,** Washington, D. C., prescribes and furnishes rules and regulations relating to **Improved Channels, Harbors,** and **Drawbridges,** excepting the lights to be exhibited on drawbridges, which are prescribed and furnished by the **SECRETARY OF COMMERCE AND LABOR.**

The **BUREAU OF LIGHTHOUSES** and **COAST AND GEODETIC SURVEY,** Washington, D. C., furnishes a weekly **Notice to Mariners,** containing changes in **Chart and Navigation Aids.**

The **HYDROGRAPHIC OFFICE,** Washington, D. C., in a weekly **Bulletin,** gives important changes, especially dangers to navigation.

SPECIAL STATUTES sometimes cover isolated rules, but they are usually promulgated by one of the above authorities.

There are also **State** and **local laws,** not in conflict with the Federal rules and regulations; and the **law of custom** and **usage,** when not in conflict with any of the rules stated.

PART I.

PRECAUTIONARY AIDS.

NOTE.—*In determining the intention of these aids, the remarks under any point are to be understood as forming a part of the entire body of precautionary aids, and not as though each point stood separate and alone. They must be construed in a nautical sense and applied as seamen understand and apply them. For example: Under "Crowded Waters," "Fog or Other Heavy Weather," "Anchoring," Etc., particular requirements are stated, but all related points, stated in other parts of this manual, also apply.*

MAJOR DEFINITIONS.

Vessel.—A vessel includes every description of water craft, or other artificial contrivance, used or designed as a means of transportation on the water. The Federal Courts have also extended Admiralty Jurisdiction (the rules likewise following) generally to all contrivances used on navigable waters united in a continuous highway over which commerce may be carried on with other States or foreign countries, regardless of their use as a means of transportation.

Steam vessel.—Any vessel propelled by machinery.

Every vessel under steam, (or propelled by machinery) though it may be also under sail, is to be considered a steam vessel.

Sailing vessel.—Any vessel under sail, and not under steam (that is, not propelled by machinery).

Navigator.—The term navigator used herein is intended to cover one who is engaged with questions of navigation and seamanship.

Under way.—A vessel is deemed under way when it is not at anchor, or made fast to the shore, or aground. ***When under way it should perform all the duties prescribed by the rules for moving vessels.***

Burdened vessel.—The vessel required by the rules to ***keep out of the way*** of the privileged vessel.

Privileged vessel.—The vessel required by the rules to ***hold its course and speed,*** to enable the burdened vessel to keep out of the way. (See ***Right of Way,*** page 34.)

The "situation."—The ***"situation"*** embraces the ***positions*** during the time care and caution must be exercised.

The "positions." —As has been seen, the situation embraces the entire relation between two or more vessels, but the positions cover the particular ***stages*** of a situation.

As it will be necessary to comment on these positions, they will be described and illustrated under ***General Precautions,*** page 9.)

This is not to be applied to geographical positions.

Negligence of owners.—This relates to any defect or insufficiency in the ship's hull or equipment with the "privity or knowledge" of owners (termed ***unseaworthiness)*** and involves serious penalties. (See ***Manning and Equipment,*** page 5, and ***Inspection,*** page 131; also see ***Permanent Abandonment,*** page 83.)

Negligence of officers and crew.—Failure to exercise that degree of diligence, care, and judgment generally to be found in persons in the particular calling who faithfully and prudently discharge their duty. A personal liability for negligence also exists, wholly apart from the liability of the vessel.

Collision.—A contact between two vessels.

A collision may be actual or implied. It is actual when the vessels in contact are alone involved. It is implied where a vessel, or object, is forced into collision by another vessel which does not itself collide, or where a third vessel commits the fault leading up to the collision between the two vessels involved.

Precautionary Aids.—The words *"Precautionary Aids,"* used in this manual, are intended to convey the idea of helps or suggestions; they are not binding rules of conduct to be invariably followed when a departure therefrom would avoid a collision.

For ***minor definitions*** and marine nomenclature, see Paasch's *"Illustrated Marine Encyclopedia"*; Patterson's *"Nautical Encyclopedia"*; Luce's *"Seamanship"*, Revised by Ward, and the works referred to in the ***bibliography*** pages 135–147.

THE RULES OF THE ROAD.

The localities and subjects covered by Governmental rules and the authorities charged with their distribution are shown in note opposite page 1.

It is peremptorily required that Governmental Rules be thoroughly understood by every navigator using the locality to which they apply. The rules and circulars issued thereon should be regularly posted. A vessel not having these rules and circulars (relating to the waters navigated by the vessel) posted in a convenient place for reference, as required by law, visits upon the owner of the vessel severe penalties and subjects the navigator to serious consequences.

Everyone who may be called to account for disobedience of the rules should be required to sign each circular of information, and notice of change, as evidence that he has seen it, and to impress upon him that he cannot neglect the information. (See Note opposite page 1, showing how this information can be obtained.)

The Government is prompt in imposing the fine prescribed by the rule both on the offender and on the vessel.

In addition to the rules of the road, all practices that are the outgrowth of sound seamanship also apply; that is, care and diligence must be used to meet the difficulties of a "situation" in a skilful manner.

APPLICATION OF RULES.

When "International" and "Inland" rules, prescribed by Federal authority, apply.

The *international* rules apply to vessels when on the high seas, that is, when *outside* of the line dividing the high seas and coast waters, as defined by Governmental authority.

The *inland* rules (supplemented by the Supervisor's Regulations, and the Regulations prescribed by the Secretary of Commerce and Labor and by the Secretary of War and special statutes), apply to navigation in all inland or inshore waters, that is, *inside* of the line dividing the high seas and coast waters, as defined by Governmental authority, excepting certain designated interior inland waterways, which have their own prescribed rules, as explained in the note opposite page 1.

All other rules specifically define their territory.

When local, state, county, and municipal laws, and the law of custom apply.

State, county, or municipal laws and ordinances (when not in conflict with the Federal Rules, as enlarged by the Steamboat Inspection Service regulations, etc., as above stated), must be obeyed. All ports, generally, have such local rules and regulations, particularly as to speed in harbors, fairways, and channels, the location of anchorages, and the method of lying at wharves and of entering and leaving slips.

Where a well-known *custom* or *usage* prevails in a given locality, it should, when practicable, be complied with, if it is not in violation of the Government rules and regulations, or the State, County, or Municipal laws.

When owners or managers of vessels agree to particular methods of navigation, the parties thereto are bound to observe the same when they do not contravene Government, State, county, or municipal rules, and do not conflict with the legal rights of others not a party to the agreement. *Such exceptions are bad in principle.*

Ignorance of the rules or of facts or conditions which should be known by navigators cannot be offered in excuse; but ignorance of fact, which may not be ascertained by reasonable care and skill, or causes beyond human control form the basis for excuse, as in case of an *inevitable accident;* or inexplicable cause may be determined an *inscrutable cause.*

INEVITABLE ACCIDENT AND INSCRUTABLE CAUSE.

Where controlling influences produce a collision which could not have been foreseen and prevented by reasonable skill and care, as where nothing could reasonably have been done to avoid it, or where no negligent contributing act was committed *(inevitable accident);* or where the causes of a collision are shrouded in such doubt as to make them inexplicable, or where the testimony is equally balanced, *(inscrutable cause),* the rules of the road are not applied strictly against the vessels. In such instances the damages rest where they have fallen. But these defenses are not available when the principle of "proximate cause" or "primary fault" applies, because there the unoffending vessel is excused either because its error is "remote" or that it is "immaterial." (See *Proximate and Remote Causes, and Primary Fault and Immaterial Error,* pages 43, 44.)

MANNING AND EQUIPMENT.

Failure to supply all prescribed equipment, and equipment suggested by good seamanship, under-manning, or any deficiency in experience, or physical deficiency in the officers and crew contributing to a disaster, is a neglect which will visit upon owners, or masters, serious penalties. (See *Negligence,* page 2, and *Inspection,* page 131.)

Defective vision or *hearing* is always to be avoided in the selection of crews. The color tests should always be applied. Those comprising the watch are especially required to be sound on colors, particularly white, red, and green, to determine the character, position, and course of vessels carrying lights reported by the lookout.

Every officer should be known to hold proper license to perform his duties.

Remember that naturally dull men require constant supervision.

In the selection of officers and crews, it should be held in mind that the ship's deck is no place for a timid mariner, nor is it a place for a reckless one.

Since every member of the ship's company is a seaman in the eye of the law, every one connected with the vessel must sign shipping articles, when required by the statute, and in such form, and under such conditions, as may be prescribed by the statute. The food and quarters essential to the health of seamen is one of the efficient means toward obedience to the rules. This requirement is very strictly applied to all vessels falling under this class.

RELATION BETWEEN PILOT, CAPTAIN AND OWNERS.

The pilot supersedes the master and must, without interference, be obeyed on all matters connected with navigation. *Notwithstanding that the pilot's authority is supreme, the master also has responsibilities.* He is required to warn the pilot of the ship's peculiarities. He must see that the officers and crew are attentive to their duties and obey the pilot, and that all matters, which would be brought to the master were he in charge are brought to the attention of the pilot. He is required to see that all the usual routine is being performed, without express orders from the pilot. He must see that everything is in readiness aboard ship which is to be used by the pilot for getting under way, for navigation, for making fast, or for anchoring. He is required to secure assistance from other vessels, when needed. He is responsible for the trim of the ship, and for her tackle and equipment.

The master should not hesitate at any time to offer reasonable suggestions, but suggestions should never take the form of positive commands.

Where the pilot clearly shows incapacity, or is laboring under sickness or intoxication, the master must take immediate charge of the ship, ***but otherwise no obstacles to the pilot's duties should be interjected, for interference is justified only when it is perfectly clear that safety requires it.***

Except as herein qualified, it is understood in the mercantile marine that the Captain is in sole command of a vessel under way, and owners on board may not dispute his authority in matters of navigation and seamanship. Owners should never place a Captain in the position wherein duty may be sacrificed to policy. Nothing but sickness or obvious incapacity will justify interference, by proper authority, with the Captain's command when the vessel is under way and then the next officer in line is charged with the responsibilities.

PRESUMPTIONS.

The Government rules define, among other things, the "***burdened***" and "***privileged***" vessel, and they should be very carefully memorized, for a thorough understanding of this principle lies at the base of all precautionary measures. They define the ***privileged*** vessel (the vessel that is favored by the presumption of innocence), which must hold its course and speed to enable the other *burdened* vessel to keep out of the way. (See ***Right of Way***, page 34, and the ***Relation Between Burdened and Privileged Vessels***, page 37.)

Where deficiency in manning or equipment, or failure to adopt methods prescribed by the rules or sound seamanship, is *clearly* and *convincingly* established against one vessel, the other vessel is entitled to the benefit of the doubt until the further inquiry also *clearly* and *convincingly* involves it in fault.

The presumptions of law favor the privileged vessel until investigation shows the privileged vessel is involved in fault.

The navigation of a vessel with reasonable precaution will be weighed with greater allowance on questions of seamanship not covered by the rules than will be accorded navigation of a less careful character. Prudence and care in the early positions, shown on page 11, will strongly suggest care and prudence in all subsequent positions.

When the collision is not *imminent* or *impending*, that is, throughout the first, second, and third positions (explained on pages 11 and 12), a navigator who himself obeys the law may assume that the other vessel will obey the rules, and will regulate its action to avoid danger and not incur it.

These presumptions are rebuttable, that is, may be explained, and it is permissible to show that the vessel having the presumption in its favor, or the benefit of the doubt, committed a fault, or omitted a duty imposed upon it.

There are other presumptions, and what are known as "shifting presumptions," but they relate chiefly to the technical side of litigation and do not fall within the scope of this manual.

GENERAL PRECAUTIONS.

(See also special precautions stated under the respective headings shown herein.)

NOTE.—It must not be assumed that all precautionary aids are obligatory on vessels as fixed rules of conduct—indeed the rules themselves are not applicable when they would promote, rather than prevent, collision. The precautionary aids presented herein may, EX INDUSTRIA, suggest more than the strict letter of the rule or the practice of sound seamanship require; and it does not follow that because they are not applied the vessel has committed a fault.

The test of negligence is a test SUI GENERIS, that is, it is applied in the light of the facts of each case, and how they appeared throughout the ENTIRE "situation" leading up to the collision. In a collision inquiry the test of negligence is never properly applied under an isolated rule of conduct separate and apart from the facts, or from a narrow view of the last maneuvers just before the collision.

The precautionary rule of margin.—This precautionary rule applies in all walks of life. It is particularly applicable at sea. The margin allowed for safety in any precautionary act should always be ample for the time, place and surrounding conditions, though the rules should never be disobeyed except where a departure is justified. (See *Departure from the Rules,* page 40.)

Vicious Circle.—The influence of what may, for the want of a better name, be called the Vicious Circle, is as applicable to the high seas as it is in the ordinary walks of life. The navigator may, through failure to allow sufficient safety margin, increase the tension by incurring other problems which, in themselves, increase the perplexities. Thus an effect becomes a cause, which in turn produces an effect, and so on and so long as the disconcerting influences prevail.

★ Decide prudently in all matters. Avoid indecision. ★

Indefinite action or obscure motive may mislead the other vessel, and dodging or confusion may result.

★Promptly comply with the Rules, and run no risk.★

Safety should never be sacrificed to time. Convenience or expediency are not to be allowed to interfere with safe nautical judgment.

★ Select the safer of alternative methods for avoiding danger.★

This may be illustrated in the prevailing conflict as to when the rules apply. Some authorities have held that they do not attach until the risk of collision has become ***fixed,*** but this does not appear to be a safe method. The better interpretation is, that the rules are intended to ***avoid the risk of collision,*** and that they are applicable ***when the necessity for precaution arises,*** i. e., where there is a ***probability*** of risk, or "when risk of collision" is "involved," as stated in the rules. They are ***not to be deferred until the risk of collision has become fixed and determined.*** The prudent method then, is to adopt the safer interpretation, and apply the rules promptly, when practicable, and sufficiently in advance to avoid the "risk," and thus prevent the actual danger.

As shown, under ***Major Definitions,*** page 1, the ***"situation"*** involves a number of ***positions,*** from the time precaution is required until the collision has occurred, or the vessels go clear. This is of ***prime*** importance and will be explained here.

The "SITUATION."—The *"situation"* embraces all the *positions* of vessels during the entire time care and caution must be exercised.

The suggestions under the headings: Speed, page 17; Lookout, page 22; Signals, page 26; Lights, page 29, and Allowing Ample Passing Room, page 33, should be carefully noted in connection with the relative positions named.

The "situation" may contain one, or all, of the following five positions:

(These positions refer to the daytime and good weather for seeing. Exceptions, relating to night-time and fog or other heavy weather, will be stated under the third position.)

(1.) *FIRST POSITION: When the necessity for precaution arises. The rule then applicable thereto applies.*

The "risk" is then "involved," that is, it *threatens,* but is deferred by prompt compliance with the rules by both vessels.

When the beginning of a situation (that is, the first position) establishes the relation of a burdened and a privileged vessel, the relation continues until the vessels have so far progressed that a collision could not ensue, unless a departure from the rule can be justified, or until they are "in extremis," or unless the privileged vessel, by any disobedience, abandons its privilege. (See *Right of Way,* page 34, and *Relation Between the Burdened and Privileged Vessel,* page 37. *Departure,* page 40. *In Extremis,* page 42.)

(2.) *SECOND POSITION: When the vessels signal each other and establish the first "angle of incidence" (approach).*
Here, the risk is also "involved," but may still be deferred by adherence to the rules by both vessels. The vessels, in this position, are contemplated by the rules to be so far removed, that the maneuvers required of them are, if adopted in time, designed to prevent danger.

(3.) ***THIRD POSITION: When the vessels have approached so near to each other that a collision might be brought about by any neglect of either vessel.***

The "involved" risk becomes ACTUAL in this position. See Lord Kelvin's remarks, page 21. Danger signals are often required in this position.

Up to and throughout this position each vessel, complying with the rules, has the right to presume that the other vessel will likewise obey them.

EXCEPTIONS WHEN THE "RISK" BECOMES ACTUAL IN THE FIRST, SECOND, OR THIRD POSITIONS.

It is seen that, ***in the daytime,*** when both vessels obey the rule in time, with plenty of room, good weather, and no uncertainty, the "risk" does not become actual until the third position. Indeed, careful compliance with the rules will usually eliminate the third, fourth, and fifth positions.

But ***at night*** the "risk" becomes actual in the ***first position*** when the running lights are first seen, and both vessels must then be alert to the probable dangers.

In a fog or other heavy weather (whether by day or by night) the risk becomes actual when signals are first heard, or when the vessel or her lights are first seen, and both vessels must then observe the rules with great caution.

So also, in any position, **"Risk of collision may be deemed to exist when the compass bearing of an approaching vessel does not appreciably change."**

This is vastly important and is prescribed in these exact words in the rules, and this condition may usher in risk of collision at any time. This is one of the greatest aids known, and is, curiously enough, the least applied.

Risk of collision may also be deemed to exist when there is uncertainty or doubt from any cause. (See Lord Kelvin's advice on this point, page 21.)

Special circumstances may give rise to other conditions from which risk of collision may be deemed to exist.

In any event, when the risk arises it continues until the vessels go clear, or until all doubt is removed.

(4.) ***FOURTH POSITION: When the "jaw" of the collision opens, that is, when the collision is IMMINENT or IMPENDING and when, unless one or both vessels give way, a collision is almost sure to happen.***

Here a ***departure*** from the rules is generally required by the rule of special circumstances and must be justified as a correct maneuver. It seems needless to say that the departure shall be no more than is necessary. (See ***Departure from the Rules,*** page 40.)

Danger signals are usually indicated in this position.

In some instances ***error in extremis*** may justify a mistake in this position. (See ***Error in Extremis,*** page 42.)

(5.) ***FIFTH POSITION: When the collision is inevitable.***

In this position nothing will avoid the collision. Attention must then be directed toward minimizing the result of the blow, adopting the best angle of contact, and to the work of rescue.

An improper maneuver in this position by a vessel not otherwise at fault and forced by the improper navigation of the other vessel, is not considered a negligent failure to obey the rules, and will be excused as an "error in extremis." (See ***Error in Extremis,*** page 42.)

While the above positions may at first appear complicated, skilful seamen intuitively recognize them, and may, by attention, meet their requirements if they obey the rules and act in time.

It will be seen that ***prompt*** and ***uniform*** compliance with the rule governing the situation in the first and second positions, while the risk is "involved," ought usually to afford the vessels ample opportunity to ***avoid the actual "risk" in the third position,*** and time to foresee and prevent the necessity for close tactical maneuvers in the third and fourth positions, generally made ineffective by dangerous proximity.

At night, in fog or other heavy weather, the risk usually prevails for a longer period, and generally gives opportunity to both vessels to prepare for maneuvers, when required. (See ***Tactical Maneuvers,*** page 123.)

A vessel traversing a customary route should, when practicable, keep in its usual track, because other vessels are accustomed to find it there, and should make allowance for the permanent and transitory conditions of the locality; as for instance, the noticeable change of the location of vessels, anchored or at work in the vicinity; and allowance should be made for the interfering conditions named on page 88.

The position of an approaching vessel should not alone be carefully observed to note ***whether her bearing appreciably changes*** (see pages 12, 131), but it is highly important that a navigator should consider ***how the position of his vessel appears to the approaching vessel,*** in order to anticipate what the other vessel ***may*** do.

Vigilance, patience, and a ***willingness*** to apply the rule, and the precautions dictated by experience and good seamanship, are essential aids to avoid disaster.

So, too, the rules, in order to be effectual, must be ***promptly*** applied. ***This is the keystone upon which all the rules depend.***

Delay in obeying the rules may rapidly place the vessel in one of the dangerous positions, and prevent the timely maneuvers possible in the first and second positions.

That the maneuver was proper at the time is no excuse for the delay if the rules are applied too late to avoid collision.

It is appropriate here to refer to the exact language of the courts relating to the *prompt* application of the rules:

> "The precautions required by law, to be taken where there is risk of collision, must be taken in time to determine that risk. An alteration of the helm, or other step, taken in pursuance of the regulations, is no defense, unless it be shown that such precaution was taken at the proper time. To be effectual, precautions must be taken seasonably. If taken at an improper time, they are not a compliance with the regulations, and are no defense."

A vessel which, by omission or commission, disobeys the rules must show not only that such disobedience did not contribute to the collision, but that it could not have done so.

The following is the precautionary rule:

"Nothing in these rules shall exonerate any vessel, or the owner, or master, or crew, thereof, from the consequences of any neglect to carry lights or signals, or of any neglect to keep a proper lookout, or of the neglect of any precaution which may be required by the ordinary practice of seamen, or by the special circumstances of the case."

Precautionary aids apply to all STEAM VESSELS, that is, to STEAMSHIPS, STEAMBOATS, FERRY BOATS, PILOT BOATS, TUGS, TUGS AND TOWS, MOTOR BOATS, in fact, to all vessels propelled by machinery or by machinery and sail combined (known as steam vessels), and to all SAILING VESSELS.

A BRIEF DISCUSSION OF THE PROMINENT RULES.

It will be possible now only to refer briefly to some chief *precautions*, relating particularly to the rules, and to such decisions as are founded in reason, and are generally accepted as good law. We owe much to our courts for their patient effort to solve the many perplexing problems presented to them, and, though error does creep in occasionally, they are advancing the standard of our ideals in a jurisprudence built upon personal sacrifice and consecration to duty. For the application of their intelligence and attainments, we should return our confidence, respect and obedience to the law.

Sound judicial rules defining good seamanship, when not in conflict with the statute, have the same force as statutory rules, and are added from time to time by the courts, and promulgated in their decisions. They in no sense conflict with the rules, but rather explain and make the rules clear, and occasionally add new requirements, as to seamanship, where the rules are silent.

There will be added, in the appropriate place, some practical aids to round out the point under consideration.

In event of collision a vessel may justify her navigation if her commanding officer has skilfully and promptly complied with the rules concerning *SPEED, LOOKOUT, SIGNALS*, and *LIGHTS*, and has done his part to allow *AMPLE PASSING ROOM;* unless under the rule of Special Circumstance a *departure* from the rules may be justified (see *Departure*, page 40; also *Fourth Position*, page 13); holding in mind, too, that the privileged vessel does not arrange for the passing room or speed, for she is required to hold her course and speed to enable the burdened vessel to keep out of the way.

Vessels would rarely be involved in collision if the rules were *promptly, carefully*, and *uniformly* followed in respect to:

1. **Speed.**
2. **Lookout.**
3. **Signals.**
4. **Lights.**
5. **Allowing ample passing room.**

SPEED.

This is the first and by far the most important element, and speed reductions, when effectual, lie in the ***promptness*** of their execution. ***The rules provide that speed in fogs, or other heavy weather, shall be reasonable for the time, place, and surrounding conditions, but even then they do not fix a very definite standard.***

Except in relation to fog, or other heavy weather, the rules appear to be silent on speed, but local harbor rules usually contain speed provisions. The practice of good seamanship, however, requires the speed of a vessel to be reasonable for the time, place, and surrounding conditions, and the courts inquire very carefully into this point.

Excessive speed is the primary fault with which vessels, whether steam or sail, are usually charged in every collision, and it is too frequently borne out by the facts.

Speed is a relative factor depending upon the conditions and the vessel's mobility. A reasonable speed for a high powered vessel (such as the great modern steamships, double or triple screw or side wheel vessels), equipped for quick handling, would be an unreasonable speed for a vessel slow in handling. A reasonable speed at sea, or where the waters are free of vessels, would be considered an unreasonable speed in crowded waters, harbors, or narrow channels with obstructions to the view, or in fog or heavy weather, or where surging from wash, swell, or suction would injure vessels anchored, tied to the shore, or aground, or near piers and docks where vessels are located or are constantly working in and out of their slips.

In congested waters, or where danger should be apprehended, a navigator should use the utmost caution as to speed. This also applies to a vessel whose smoke from a smokestack or galley blows forward, obscuring her or her lights. The deck and engine room watch are required to be stationed where they can act on the instant. Where there is the slightest doubt or uncertainty from any cause, or where risk of collision is apparent ***(as when the compass bearing of the approaching vessel does not appreciably change),*** or when the vessels are not in sight of each other, the vessel's headway should be stopped, and she should then be navigated with great caution until the uncertainty is cleared up. This, of course, does not apply to a privileged vessel required to hold her course and speed, unless the occasion has arisen which justifies a departure from the rule, or in extremis. (See ***Departure from the Rules,*** page 40, and ***Error in Extremis,*** page 42.) Unless by due diligence the location and course of an approaching vessel can be ascertained, the rules defining the privileged and burdened vessel do not apply in a fog until the vessels become aware of each other's character and location.

One extreme announcement by the courts is:

> "In crowded waters, in channels with obstructed views, in fogs, mist, heavy rainstorms, falling snow, etc., the speed should be such as to enable the vessel to change from headway to sternway in the presence of danger, allowing for the speed which the other vessel should be making under the rules."

Another interpretation is:

> "Speed should be such as to enable the vessel to stop in time to avoid a collision after an approaching vessel comes in sight, provided such approaching vessel is herself going at the speed required by law."

These interpretations are correct in theory and are based on utmost caution, but it may not always be practicable to apply them; however, a fair effort to do so will usually clear the vessel of fault on the point of speed, when in collision.

The provision requiring reasonable speed applies with as much force to sailing vessels as to steam vessels. Indeed high speed in dangerous places is less excusable in a sailing vessel than in a steamer, for she cannot so quickly stop or change her movements. ***She must shorten sail when required by the dangers which may be anticipated.***

While there is no set rule as to the degree of speed, no vessel should be found going at a greater speed than that consistent with due care and caution, and conditions may require the speed to be reduced to bare steerage way, or she may be required to anchor until the danger passes.

The test of proper speed, in all cases, is the ability of the vessel to stop her headway in the presence of danger.

The ***relative*** speed (that is, the excess of one above the other) between two approaching vessels is not usually affected by current, swell, wind, or leeway, except when one is caught in a cross current of either, for they are both moving (in the same picture) under the same impulse, and the "send" and drift is about the same.

But, considered alone, the speed of a vessel, "over the bottom," is somewhat affected by wind and leeway, and considerably affected by current and swell, the propelling or opposing force of which must be taken into consideration in connection with the log speed through the water. When these influences are operating in opposing directions the difference is known as the "resultant" of one over the other, which then becomes the factor to be applied. Sometimes ground logs are of value to test with the regular log, to determine the "send" and drift.

The ***combined*** speed must always be taken into account in reference to the time it takes to reach the collision point, by adding the two speeds together, but the deflecting influence, after the vessels have collided, is usually the resultant force ascertained by deducting the less from the greater speed, and allowing for any further obstruction, as for example, the hawser of a tow, or for the sinking vessel's striking bottom.

Speed in approaching and passing vessels anchored, made fast to the shore, moored, or aground.—Proper signals, control of speed with ample passing room, and the selection of the proper side of anchored vessels and vessels working in channels, are the essential requirements in this situation. (See *Method of Passing,* page 119.)

Slowing, stopping, and backing.—In slowing, stopping, and backing, *promptness of the maneuver is essential.* Reducing speed and stopping are, as a rule, always proper. It must be observed that this does not apply to a privileged vessel, which is required to hold her course and speed, unless the occasion has arisen which justifies a departure from the rule. (See *Departure from the Rules,* page 40.)

Where speed reduction, stopping, or backing is not applied in time, it is a matter of judgment under the special circumstances whether it is proper, since it may produce, rather than prevent, collision. This depends upon where the other vessel is located, the amount of forward movement, the location of the helm when reversed, and the "cant" of the vessel's bow when reversed.

The Cant.—A right hand wheel will "cant" the bow towards starboard, and a left hand wheel, towards port (the swing really occurs at the stern); but this is modified by the degree of forward or stern motion in combination with the action of the engines (whether in forward or reverse motion), and by the helm action. (See *Luce's "Seamanship,"* revised by Ward.)

It must be observed that the wind, current, and swell will affect these usual "canting" movements. A vessel will generally run her stern into the wind, current, or sea, especially when loaded by the stern, and may throw her bow away from the direction she otherwise would "cant" under reversed engines. "Canting" appears to be greater during sternway than when first reversed.

Danger from the cant of the bow, under reversed engines, will usually be avoided by ***prompt*** maneuvers to avoid the ***risk*** of collision, ***before getting into the "jaw" of danger.*** (See *Tactical Maneuvers,* page 123.)

If backing will add to the dangers and render a collision certain, because of the "cant" of the vessel's bow, where, otherwise, the vessels would go clear or do less injury, it is not the proper maneuver.

Backing is always proper when it will avoid collision, or where the "kick" or the "cant" toward the other vessel will produce less injury than the forward movement, or where it is done to overcome headway before getting into close quarters (see the *Kick,* page 121, and *Advance,* page 122.)

If the engines are backed at the time the wheel is put hard over, then the *"Kick"* (see page 121) must also be taken into consideration.

Quick water forward is not always proof of a full stop.

The observations of Sir William Thompson (Lord Kelvin) are to the point:

> "It is not an exceedingly rare incident for two steamers on the wide ocean, in clear and moderate weather, to be on such courses that they cannot, in the nature of things, escape collision otherwise than by the fulfillment of Article 16 (slackening speed, or if ncessary, stopping and reversing). How can a man walking towards a mirror escape collision with his own image? Only by slowing and stopping. Or two men meeting on a broad path, with plenty of room to pass one another, how often does it not happen that they can only escape collision by one or both stopping? The Rule of the Road at sea seems to me good in almost every particular as it stands in the International regulations. The most perfect steering rules cannot but leave a margin of

> **doubt in the limit between the two cases in which a ship ought to alter its course and ought not to do so, or again between the two cases in which a ship ought to alter its course in one direction, and ought to alter its course in the other direction. This doubt essentially involves risk of collision, which can only be obviated by the fulfillment of the first clause of Article 16 (slowing, or when necessary, stopping and reversing).”**

(See ***Tactical Maneuvers,*** page 123; ***Speed in Fogs or Other Heavy Weather,*** page 64; and see also ***Navigation in Crowded Waters,*** page 70.)

LOOKOUT.

The lookouts are the “eyes of the vessel.” They are indispensable. No rule is more strictly enforced by the Courts. This rule is enforced against all classes of vessels; it applies in all waters, and is required both by day and by night.

Added vigilance is necessary where there are added or unusual dangers, for, indeed, lack of attention on the part of the lookout is a fruitful source of collision.

The rules are silent on competency, location, duties, and the number of lookouts necessary.

Competency.—The manning of a vessel peremptorily requires experienced and physically able seamen of proper age to perform the duty of lookout. It is gross neglect (if contributory to a collision) to allow a lookout to perform such an important duty when he is young or inexperienced or his hearing or eyesight is defective, or to overtax him in too long continued duty on the lookout.

Effort should be made, in the ship’s equipment, to screen a lookout from biting winter winds. No man is competent to perform his duty in the teeth of a biting wintry blast which chills the system, lowers the vitality, and has a stimulating effect on the lachrymal glands, producing "water eye." Under such conditions the attention is not sustained and the vision is obstructed. Protection is provided for motormen and automobile drivers by portable glass screens. Why is not the same humanity extended to the lookout? This can be done at small cost without the slightest impairment of attention, and, indeed, it would raise the standard of efficiency. This is only suggested as an emergency protection, in such instances where a lookout ought, otherwise, to be taken in. In low fogs, vapor, sleet, chilling rains, blizzards, or cold winter winds, a comfortable "crow's nest," with a speaking tube to the navigator, is almost indispensable. Short periodic conversation with the lookout will prevent his dozing.

The master or officer of the vessel as the sole lookout is not a compliance with the rule. The reason given is that the care of the vessel and responsibility resting on such master, or officer, does not permit the fixed attention required of a lookout. If a master, or an officer, takes the lookout, it is an evidence of caution, ***when the technical lookout is also kept regularly at his post.*** It is, however, well known among mariners that the main vigilance, ***and the very best protection,*** lies in the cautious observation from the pilot house by an attentive and experienced watch.

But there may be an exception to this rule in small craft where the lawful crew list does not permit keeping a seaman on the lookout, providing a sharp lookout is shown to have been kept by the watch, and all was done that a technical lookout could have done.

Location.—The location of the lookout should be forward, in what is known as the "eyes of the vessel," so that his duties may not be interrupted by conversation, nor his attention diverted by the happenings on deck or in the pilot-house. His view should be unobstructed, for he is required to observe and report lights from ***all*** directions. Passengers should be roped off, so they may not distract his attention or obstruct his view. When the vessel is backing or at rest it may be necessary to station an additional lookout at the stern.

Certain weather conditions, especially low fogs, may require that a lookout be placed aloft, in the "crow's nest," or stationed, during high wind, where he will not be in a strong noisy draft if it interferes with hearing.

When the weather will not permit a lookout to remain in the usual location forward, he should be stationed in a safe place, and vigilant efforts made to assist him in his duties.

Duties.—The lookout should be alert and vigilant in reporting all objects and sounds wherever they may be located. ***His whole attention must be directed solely to this duty, without other duty to distract attention.*** A vessel must not only govern its action with respect to approaching vessels, but must hold its course and speed with relation to overtaking vessels, and where one lookout cannot perform the full duty a sufficient number must be provided to do so. An overtaken vessel, not carrying a regulation stern light prescribed by the rules, ***must observe the overtaking vessel in time*** to exhibit to such overtaking vessel the lights prescribed by the rules.

Lookouts should be instructed to also ***watch for the loom of vessels, derelicts, or wrecks without lights, and to listen for the beat of the propeller or wheel,*** and for breakers and echoes or other sounds. Such extra vigilance will insure the best results.

At night frequent observations by marine glasses from the pilot-house may be helpful in supplementing the observations of the lookout.

The Courts have supplemented the rule relating to lookouts by this observation:

> "The office of a lookout is to watch for and report danger from whatever quarter it may be expected. * * * He must be stationed where, under the circumstances of the situation, he can best perform all his duties, and if one cannot do all

> that is required another must be added. Ordinarily, in open waters, one is enough for all purposes, and his station should be at or near the bow."

The lookout is not expected to use his judgment as to whether a report should be omitted, and he is not, to assume that others see or hear objects before his report.

The lookout should repeat his information until the pilot-house answers by jingle bell or otherwise.

A lookout may be taken from his post for other service, but only when imperatively required by a greater peril than the absence of the lookout. The burden is on the one thus departing from the rule, as in all departures, to justify his conduct.

Under appropriate circumstances the absence of a lookout may be satisfactorily explained.

When at anchor in a place where due caution and prudence requires an anchor watch to observe the anchor light, the anchor watch should also keep a lookout for approaching vessels, ready to aid in giving all proper notice, and prepared to haul in, or let out, or slip anchor chain, if required.

Much aid would be afforded lookouts if the lighter colors were used in painting. The loom of a light colored hull, white buoy, or, indeed, weather-stained sails, may be seen some distance at night. Some governments use considerable white for marking buoys and other aids.

The color has much to do with visibility at sea. Color is produced by extremely rapid vibrations sent off by the reflecting pigment (the pigment is, itself, colorless). The pigment contains the property of selecting the particular color from the light and reflects it, at the same time absorbing all other color. On a "dark" night (no moon, but starlight), there is much light which might be utilized in this way.

(See *Anchor Watch,* page 80.)

SIGNALS.

The method of giving the various signals is fully prescribed in the rules.

Here, as in speed, *promptness* is of the first importance. A large number of collisions are due to the omission of this essential requirement.

There is a personal penalty of $50, applicable to each delinquent, for each failure to obey the rules. Although this applies to a disobedience of any rule or regulation, it may be availed of here to do much good. A navigator of any steam vessel, be it large or small (from an ocean liner down to the smallest motor boat), who fails to promptly give and answer signals, should be singled out by all cautious navigators as a *menace* to navigation. In this instance it is particularly within their power to notice such a disobedience, where infraction of the other rules may be more or less concealed within the knowledge of the guilty vessel.

Prompt report of failure to signal should be made to the Government officials. By reporting these offenders, navigators who are habitual rule violators, in this and other respects, will receive effectual discipline. What has saved these offenders in the past is the natural reluctance to being an informer, but this mistaken view should be abandoned. Habitual rule violators deserve no sympathy. They are the kind of indifferent men who involve other careful navigators, in other respects, and often have no conscientious scruples against evading the results of their own gross negligence by deception and perjury.

The main value of the signals depends upon watchfulness and a *desire* to *promptly* give and answer them. *They should be given or answered in time to prevent mistake.*

An unanswered signal always demands great caution, and vessels *must not* proceed in close quarters without a *clear* understanding. *A vessel must not conclude that her signal has been assented to by any omission on the part of the other vessel to answer.* Signals should be repeated as often as necessary to secure answer. *This precaution must never be violated.*

Passing signals by steam vessels.—The passing signal is the preliminary conversation—an exchange of courtesies—seeking an understanding to avoid collision; and who is so lacking in breeding as not to reply to polite salutations?

The statutory method of passing, that is, whether to starboard or to port, as provided by the rules, cannot be violated, except under mutual consent, clearly understood and accepted under appropriate signal and answer; and, notwithstanding such agreement, the vessel which changes the method of passing prescribed by the rules, unless it be a justifiable departure from the rules, assumes the risk of the maneuver. (See *Departure from the Rules,* page 40.)

Danger signals by steam vessels.—Danger signals are important and are required by the rules under certain conditions; yet they are comparatively rarely given in time, and a vessel often finds itself in fault for what might otherwise be perfect navigation through the mere omission to sound danger signals when danger exists. The excuse is usually made that other and more important duties such as backing or helm action required attention. This is very often the case, and, when occasioned by the fault of the other vessel, may be a valid excuse, but it is not intended that the danger signals are to be deferred until the position is so desperate that they cannot be given. Here, again, *promptness* is of the first importance. The danger is usually observed quite early in a "situation," and the signals should be given in time, especially where the threatened danger is not observable to the approaching vessel. (See the *Third* and *Fourth Positions*, pages 12, 13.)

Where both vessels clearly see the danger their omission may not be held to be a fault.

No vessel is required to give danger signals when the danger is not observable, or where they would be more liable to confuse, or where they would do no good.

The "International" rules, applying to the high seas, do not prescribe danger signals. No harm can result in giving them anywhere the occasion requires them, as a precaution under the rule of special circumstance.

Backing signals by steam vessels.—The rules of some localities do not prescribe backing signals. Since backing is always a danger point to overtaking vessels, no harm can be seen in at least repeating the danger signals, under the rule of special circumstances, when backing, in localities where the rules do not provide special backing signals.

In the "Inland" rules the provision is imperative on this point, and there is no rule more generally violated, probably because it is supposed when danger signals are given they suffice for backing signals.

The backing signals under the "Inland" rules are especially prescribed, and are different from other signals. They are supplementary to the danger signals and serve three purposes:

1. To accentuate and to confirm the danger signals.
2. To fix a definite time when it may be determined by all within hearing that the engines are backing.
3. To warn other vessels in the vicinity, and astern, to protect themselves.

The rule seems to require a steam vessel to sound backing signals not only when backing in situation with a steam vessel, but also when backing in situation with a sailing vessel.

Alarm signals by steam vessels.—An alarm signal of one long blast is required at bends in channels where vessels may be located and unseen, or when moving out of, or from behind, slips, docks, or other obstructions; the navigation, thereafter, to be controlled as provided by the respective rules.

Distress signals.—Distress signals are also provided by the rules and must not be confounded with other signals so prescribed.

Special signals.—Special detonating signals may be used to attract attention when they cannot be mistaken for the distress signals prescribed by the rules.

Naval and recognition signals.—There may be special Naval and marine recognition signals provided by the respective Governments, when duly registered and published.

Unnecessarily sounding signals in harbors subjects a licensed officer to suspension or dismissal and is an offense against local law.

Running, and Anchor Fog Signals.—See *Navigation in Fog or Other Heavy Weather,* page 61, and *Anchor Fog Signals,* page 81.

LIGHTS.

Character, size, location, screening, and visibility.—*The rules give minute directions as to the character, size, location, and color of lights prescribed for the various classes of vessels, and provide how the side lights (the port and starboard colored lights), and other running lights are to be screened.* The courts rigidly adhere, in the minutest detail, to the requirements of these rules.

The word "*visible*" used in the rules means visible on a dark night, in a clear atmosphere, the distances prescribed by the rules. They must be displayed from *sunset* to *sunrise.*

Duties as to lights.—The obligation to exhibit proper lights by one vessel, and the required effort on the part of the other to discover them, are equivalent duties, the importance of which cannot be too firmly impressed upon those charged therewith. The lamps required by the rules must not only be of regulation size and properly set, but must be kept clean and well supplied and *inspected at stated periods to know that they are burning.*

They must not be obscured by deck houses, sails, smoke from galleys, oil, grease, or other objects, nor should any other lights, not prescribed by the rules, be exhibited in any way to confuse, or to engulf or absorb the regulation lights. In a collision the inquiry is not that the lamps were lighted at sunset, but that *they were burning brightly at the time of the collision.* When there is any uncertainty about the lights a vessel is showing, the vessel so observing should sound danger signals and stop her headway until the danger is past. If in close quarters she should be reversed, when practicable, to kill headway, and the backing signals, when prescribed for the locality, should be sounded.

Defective lights may, and frequently do, invite disaster. Close attention should be given those on the observer's vessel and those exhibited by the approaching vessel. When possible to advise a passing vessel of imperfect lights, it should be done. A universal signal for this purpose would be a wise addition to the rules.

Failure to see lights, when they could have been seen, in time to avoid a collision may indicate an insufficient lookout. Even though lights may not be in full accord with the rules, yet, if they are sufficient to warn an approaching vessel, the vessel failing to observe them will be held at least partly in fault for not keeping a proper lookout. Where proper lights are mistaken for other lights, there is no excuse for error in the absence of an effort to determine what the lights really are. Fixed or moving lights in a background can rarely be urged in extenuation for mistake made in relation to moving lights in the foreground of a situation. Notwithstanding a vessel may have displayed all proper lights, she cannot rely on this alone if she does not apply any other reasonable means to avoid the collision, which may be open to her. No other lights shall be exhibited which may be confused with those prescribed by the rules. In hazy or foggy weather it may become necessary to darken the foreground by shutting off the reflection of saloon or cabin lights to aid vision. (See *Anchor Lights*, page 80, and *Search Lights*, page 33.)

Location of running lights on sailing vessels.—While there is no rule prescribing the exact location of running lights on a sailing vessel, they should be so located that they may not be obscured by other lights, or by deck houses, sails, smoke from galleys, oil or grease, or other objects; otherwise their location is a fault, with consequent liabilities. Very great care should be used both in screening and in watching running lights when placed in rigging. Such lights are intended to be stationary, but they frequently so change under sail pressure as to give an approaching vessel the impression that the sailing vessel has changed its course. A light so arranged, without sufficient screens and constant inspection, will visit severe penalties upon the offending vessel. A constant source of danger attending lights placed in the fore rigging is the failure to *fix the inboard screens rigidly on a line with the keel,* and also in perfect perpendicular. The fore rigging shrouds usually lie inboard forward, and the angle from the rail to the mast also causes them to lie toward the keel line. *If these spaces are not filled in before the screens are attached, the lights will certainly show across the bow,* and an approaching vessel may be deceived. The burden will then be on such offending vessel to show that such construction not alone did not contribute to the collision, but that it could not have done so. (See *Inboard Screens*, page 32.)

Starting or lifting the jib or fore staysail sheet when running free may shut in the leeward light to an approaching vessel.

The inboard screens of the colored running lights.—The rules require that the inboard screens of the colored running lights, on all vessels, shall be so arranged that the light will show straight ahead to two points abaft the beam on the port and starboard side respectively, and further that the lights shall not show across the bow. However, in order that an approaching vessel may be warned that she is about to cross ahead of a vessel, it is essential that those on her ***may be able to see the far side colored light of the other vessel BEFORE passing her keel line,*** and this has required the lights to be so rigged that the light rays cross some distance ***ahead*** of the stem of the vessel, ***but never so they may show across her bow, that is, can be seen from the stem of the vessel.*** The inboard screens should be placed with great care, for, notwithstanding the lights must cross some distance ***ahead of the stem,*** in apparent violation of the rule, the mistake of having them cross too close to the stem may invite disaster. ***If the screens are of the length prescribed by the rules, and are placed exactly parallel to the keel, and the lamps are set in their proper places, they will cross at the proper distance.*** An inboard forward tilt (of the screens) of but two points will throw the light rays sixteen feet toward the opposite side in a distance of forty feet, and would, in violation of the rule, ***cross the bow*** of a thirty-foot beam vessel; this is a constant source of deception in sailing vessels, because of the location of their lights in the fore rigging. (See ***Location of running lights on sailing vessels,*** page 31.)

The safest plan is to periodically inspect the lights from the extreme tip of the stem to see that neither running light shows, making full allowance (in a sailing vessel), for the spring of the shrouds. A periodic inspection from a point several hundred feet forward of the stem should also be made.

It has been suggested that there be established a more accurate method of testing the visibility of lights, and that the inspection laws be extended to the equipment of *all* vessels. Great laxity as to lights and their location now exists on the part of owners of small vessels not included under the inspection laws, and, indeed, the lenses are often selected with but a faint trace of the required color; even vessels included under the inspection laws show a wide range of color shades. The only solution seems to be to set an *exact standard* and to require, by rigid inspection, that *all* vessels comply with it.

Search lights.—The search light is not required by the rules. If a vessel sees fit to carry a search light it must then, as with all other equipment, be kept in order, for use when emergency demands it. Its use must always be justified and should be governed by necessity. Observations by means of it should be made *quickly*. It should not be used in a way to "blind" observers on other vessels. A strong ray of light projected in the foreground will shut out the background which might otherwise be seen. Unnecessary or a prolonged use of the search light may be held to be a fault. The use of a search light for amusement is gross negligence, and cannot be too severely condemned. Lights carried or operated in a way to confuse subject the officer's license to suspension or revocation. The Government practice stations should be warned not to hold their search lights on vessels unnecessarily long; this is growing to be a new source of danger.

Tell-tale lights.—Tell-tale lights require careful watching, and this is true of all automatic equipment.

ALLOWING AMPLE PASSING ROOM.

The rules do not specifically refer to this point, but it is indirectly covered by the rule of special circumstance, by the precautionary rule, and by sound seamanship.

Omission in this respect is a most prolific cause of collision. The passing room should be sufficient to allow for mistakes, misunderstandings, fear, or unexpected suction or sheer. It is improper to unnecessarily crowd vessels when leaving their slips, moorings, or anchorages, or to proceed at a speed liable to cause injury to vessels by wash, suction, or sheer. It may be necessary to closely approach vessels under some circumstances. Here the speed, the ability to give and execute orders to the quartermaster or helmsman, to communicate orders to the engine room, and to have them *promptly* executed, are of the first importance. The burden is on the vessel making such a close approach to do so without injury and without causing undue anxiety to those on the other vessel.

This point applies with equal force to "burdened" sailing vessels when approaching "privileged" sailing vessels, or when overtaking and passing any other vessel, but does not require a sailing vessel, when "privileged," or any other privileged vessel, to change her course or speed. When going about on another tack, a "privileged" sailing vessel may, when practicable, shape her course for ample clearing room, but she should not change her course or speed after it is set. (See *The Relation Between Burdened and Privileged Vessels,* page 37.)

The use of the helm *too early* or *too abruptly* in narrow channels invites a sheer. (See *Suction and Sheer* and *Method of Passing,* pages 115 to 119.)

RIGHT OF WAY.

It is of the utmost importance to become thoroughly familiar with the rules defining the "privileged" vessel, required to hold its course and speed, and the "burdened" vessel, required to keep out of the way.

It is obvious that the "right of way" does not entitle a privileged vessel to unbridled rights. The privileged vessel is not as free in this respect as the burdened vessel, for it is the latter's movements which are unrestricted, provided it keeps out of the way and does not confuse the privileged vessel.

Keeping out of the way means by all available means, that is, by helm action, by slacking speed, stopping and reversing, if practicable and necessary.

This situation arises according to the ***character*** of the vessels, or the ***position*** they are in, and is not limited only to a burdened steam vessel and a privileged sailing vessel in "situation"; e. g., one steam vessel may be burdened and the other steam vessel may be privileged, or one sailing vessel may be burdened and the other sailing vessel may be privileged. An overtaken vessel of any character is privileged and the overtaking vessel of any character is burdened.

The ***right of way*** arises when two vessels are approaching each other in such a way as to involve ***risk*** of collision, one being ***privileged*** and having the ***right of way*** but required to hold its course and speed, while the other is ***burdened*** with the requirement to ***keep out of the way.***

Here, however, there are reciprocal obligations, and there is no special advantage conferred upon either vessel. There is the obligation on the burdened vessel to keep out of the way, and there is a corresponding obligation on the privileged vessel to hold its course and speed. ***The privileged vessel shall keep its course and speed to enable the burdened vessel to accurately determine how to keep out of the way. From the time the rules first attach until the vessels go clear this rule is absolute, and must not be infringed by either vessel.*** (See ***Positions*** 1 to 5, pages 11 to 13; also see "***Risk,***" explained under exceptions, pages 12 and 13, and "***Tacking,***" page 39.) But if, for any reason, the compliance with the rules is not seasonably observed and the collision is almost sure to occur unless the vessels give way, there is then no unrestricted right of way.

Obviously there can be no right of way into a collision.

When a collision appears to be imminent each vessel must do all that it can do to avoid the collision, even though it may require a ***departure*** from the rule. (See ***Departure from Rules,*** page 40; also see ***Fourth Position,*** page 13.)

When a privileged vessel fails to respond to signals it is not an abandonment of its right of way, nor is an answering signal by a privileged vessel an abandonment of its privilege. Signals required under the rule do not take away any rights of the privileged vessel, nor do they confer any benefits on the burdened vessel. A privileged vessel, required to hold its course and speed, abandons its right of way when it unnecessarily changes its course, increases or diminishes its speed, stops without sufficient cause, when by any deception or improper insistence by signals or bad seamanship, it requires the burdened vessel, not otherwise at fault, to resort to a departure from the rules to avoid a collision, or where it improperly forces upon a vessel close tactical maneuvers to avoid it.

It should be repeated here by way of emphasis, that the vessel which first signals neither gains nor loses any advantage under the rules; i. e. a privileged vessel which first properly signals does not thereby abandon her privilege, nor does the burdened vessel release herself of her burden, by securing an answer from the privileged vessel; but if either vessel attempts to change the statutory method of passing, or departs unnecessarily from the rules or the practice of sound seamanship, she assumes the risk of the maneuver. (See ***Signals,*** page 27.)

It has been held that between two steam vessels the starboard bow rule (which otherwise would make the vessel having the other on her starboard bow the burdened vessel) does not apply in channels or fairways where the sinuosities or contour require obvious change of position. The starboard side of the channel rule is, however, then of full force and is, so far as it is safe and practicable, designed to keep the vessels on their own starboard side, and parallel to each other, to pass with ample safety room. (See ***Starboard Side of Channel Rule,*** page 72.)

So too will an overtaken vessel hold her course, within the contemplation of the rules, even though she follows the customary trend (sinuosity) of the channel, or in rounding headlands, when such a course must be obviously required of her.

It has also been held that, where one overtaken vessel yields to a vessel forward of her beam under an agreement made between the vessels, the rear overtaking vessel must anticipate such a movement and keep a safe distance away.

THE RELATION BETWEEN BURDENED AND PRIVILEGED VESSELS.

The duty of a burdened vessel, to keep out of the way of a privileged vessel is no greater than that of the privileged vessel to hold her course and speed, in order that the burdened vessel may be enabled to perform her duty. The privileged vessel has, in fact, less freedom of action than the burdened vessel, because the burdened vessel must be active in her efforts, whereas the privileged vessel is, in a sense, passive. The passing distance should be sufficient to prevent the privileged vessel from having the chance to commit a fault and then to offer the excuse that the burdened vessel crowded her to the point of confusion. On large bodies of water with plenty of room it may be negligent for a burdened vessel to approach near a privileged vessel. In narrow fairways and channel navigation a narrow margin is often necessary, but the precautions as to speed, helm action and passing distance should always be equivalent to the danger, and sufficient to avoid the *risk* of collision before the actual danger arises. (See *Allowing Ample Passing Room,* page 33.)

A privileged vessel is bound to give way when placed in a position where it is plain it can govern its navigation better than the burdened vessel or where its difficulties are observable. The burdened vessel should supplement such a situation by proper signals, calling the privileged vessel's attention to the disability, and adopt every practicable means to avoid the danger. Privileged vessels are, however, cautioned against departing from the rules *except when a departure from the rules may be justified.* (See *Departure from Rules,* page 40, and *Fourth Position,* page 13.)

When sailing vessels or other light draft vessels are using or crossing dredged channels, they are using the only water available to deep draft vessels; therefore *they must not assume, because the side lights of a steamer appear to bear down on them, that she will not keep out of the way.* Deep draft vessels cannot run the risk of changing their helm too early or too abruptly, and must, in a narrow channel, appear to be bearing down on the other vessel, because a change too early or too abruptly, invites the most dreaded result—a rank sheer towards the channel side.

Many collisions have been caused by a privileged vessel's improperly assuming that the burdened vessel would collide with it, thus defeating the maneuver by changing its course, when, in fact, the burdened vessel was well under command, and would have kept out of the way, had the privileged vessel relied on its doing so. *This is by far the most frequent cause of channel collisions between burdened vessels and privileged vessels.* And, after acting rashly, the privileged vessel generally succeeds in covering the real negligent cause of the collision by the excuse of "error in extremis." A careful investigation of such conditions will usually show that the privileged vessel not only unnecessarily took the fairway but committed the first primary error; but being the favored vessel, the untruthfulness of her story, that she held her course until "in extremis," is most difficult to disclose. It is always safer to assume (with the presumption of law) that a burdened vessel will obey the rules, until it is positive it *will not* do so, and not to fret under the suspicion that it *may not* do so, for this invites want of confidence which ultimately leads to doubt, dodging, and confusion.

A sailing vessel is required to finish its tack and to come about on the other tack with the utmost promptitude. It is not required to stand ***"in stays,"*** or to "tack," "wear," or "jibe," to allow another vessel to pass. But a sailing vessel must observe obvious difficulty under which the burdened vessel may labor; so too must the burdened vessel observe any condition which would prohibit the sailing vessel from beating out its tack, and be prepared for the sailing vessel's accidentally "missing stays," "wearing," "jibing," or "tacking," before beating out its tack, or because of obstruction. A sailing vessel is not warranted in negligently embarrassing a steam vessel, and she must select such time to take her next tack as to not make it difficult for the burdened vessel to keep out of the way. Unskilful navigation of another vessel requires the vessel so observing it to exercise extra caution.

(See *Right of Way,* page 34.)

Steam vessels approaching steam vessels.—The privileged and burdened character of steam vessels in the same "situation" is fully defined in the rules and should be carefully studied.

Steam vessels approaching sailing vessels.—A steam vessel is burdened and a sail vessel is privileged in the same "situation."

Sailing vessels approaching sailing vessels.—The privileged and burdened character of sailing vessels in the same "situation" is fully defined in the rules, and they should be carefully studied.

Overtaking and overtaken vessels.—An overtaking vessel of any character is burdened and an overtaken vessel of any character is privileged.

Unencumbered and encumbered vessels.—Under some circumstances a vessel, which is laboring against great odds, may have a privilege against one free and unobstructed in its movements; but no permanent rights are thus established, nor do they continue longer than the conditions which give rise to them exist. No rule can be laid down to cover such conditions, depending, as they do, upon the circumstances of each case. It is seen that this arises under the rule of "Special Circumstances" and not under any rule defining the privileged and burdened vessel. But when the condition does arise, the rules defining the burdened and privileged vessel give way to it; for example: A vessel ordinarily privileged may become the burdened vessel when it is free in its movements, and the vessel laboring against great odds, though ordinarily burdened, may become the privileged vessel.

The weight of the presumption favoring the privileged vessel requires, in all fairness to the burdened vessel, that faults alleged against the privileged vessel be carefully scrutinized.

Fog, etc.—In a fog or other heavy weather the rules defining the privileged and burdened vessel do not apply until the vessels become aware of each other's presence, character, and location, but the vessel soon to become burdened must be on the alert to assume her burden instantly.

(See *Fog or Other Heavy Weather,* page 60.)

DEPARTURE FROM THE RULES.

The sailing and steering rules were designed to *prevent, not to promote* collisions. *It more frequently occurs that collisions are the result of non-compliance with the rules, or of a belated or unskilful effort to comply with them, than in their skilful and prompt application.* When delayed until in extreme danger the rules are usually ineffective. The rules contemplate their application *in time to prevent "risk"* of collision, before the *"jaw"* of the danger opens. (See the *five positions,* pages 11 to 13.)

The rules were aimed to prevent the necessity for close tactical maneuvers which generally require both vessels to depart therefrom to avoid collision.

Where the dogged adherence to a rule may promote rather than prevent a collision, or where the ordinary rules of navigation cannot with safety be applied, the navigation rule of "Special Circumstances" applies, requiring a *departure* from the rule.

THE RULE OF SPECIAL CIRCUMSTANCES.

"In obeying and construing the rules, due regard must be had to all the dangers of navigation and collision, and to any special circumstances which may render a departure from the rules necessary in order to avoid immediate danger."

Navigators will frequently find themselves in situations requiring the most delicate judgment to decide whether a rule should be applied or not. It is safe to follow the rule applicable (under the presumption of law that the other vessel will obey the rules), until it is made clearly manifest by the circumstances, or by the action of the other vessel, that the further application of the rule will produce a collision. The navigator must then depart from the rule to prevent the collision, and he must do this notwithstanding he may be called upon to justify the departure, for there is always a presumption in favor of the vessel complying with the rules and against the vessel departing therefrom.

A departure is not justifiable when it is made simply to help out; it must be peremptorily required as a *necessary* act to avoid collision.

A departure must not be more than the circumstances require, and the departure must be abandoned when it is safe to do so, and the rules again applied.

Departure from the rules is required on the grounds that he who has the last clear opportunity to avert damage or injury must embrace it. On land it is known as the doctrine of the "last clear chance."

(See *Right of Way, Etc.*, page 35; *Fourth Position*, page 13; *Error in Extremis*, page 42.)

ERROR IN EXTREMIS.

This is one of the forms of the application of "Proximate and remote cause." (See page 43.)

If due to no prior fault of the vessel, acts done ***"in extremis"*** are, if unwise, errors but not faults. A navigator complying with the rules and suddenly confronted ***through the fault of another*** by certain danger, will not be held to the standard of thoughtful calculation required of him in less exposed positions. In this sense an error may be an unwise act, but may not be a fault charging the navigator with the consequences. However, to warrant this defense, it must plainly appear that the other vessel's faults forced the act in a moment of great tension, and that the navigator was not guilty of a prior fault. It will not do to say that in the extremity of the moment a vessel is excused of error when that error was the outgrowth of a prior neglect of duty by that vessel.

Nor can a vessel delay doing what is obviously right (even if it amounts to a ***departure*** under the rule of special circumstance) and by such delay rely upon "error in extremis" when required to act in the agony of the moment.

Nor is this principle properly invoked to excuse a ***departure*** from the rule, since a departure must be made, under the rule (Special Circumstance) ***when it can be effectual, and can be justified.*** A departure from the rule is justifiable only when the act is a proper one, and there is cause to believe an imminent or impending collision may be avoided, but it must not be made while there is a fair chance of avoiding the collision by adhering to the rules.

Summarizing:

When an error is committed in the fifth position (see page 13), it may be excused, although wrong, when the vessel is required to act hastily ***through the fault of the other vessel, but is not, itself, in fault;*** but disobeying the rules with the best intention merely to help the other vessel cannot be justified as an error in extremis.

When "error in extremis" does not apply:

(a) When both vessels are in fault in their prior navigation, error in extremis is not an excuse available to either.

(b) When neither vessel is in fault in its prior navigation, error in extremis is neither a fault nor an excuse, for here the cause is attributable to "inevitable accident," (see page 5), and the damages are borne by those upon whom they have fallen.

(c) When the causes of the collision are unascertainable or inexplicable, it is attributable to "inscrutable fault," (see page 5), and the damages are likewise borne by those upon whom they have fallen.

PROXIMATE AND REMOTE, DEPENDENT, CAUSES.

"Proximate and remote cause" is a very technical principle applied by the courts to determine whether the preceding cause is sufficient to be ascribed as the sole and "proximate" cause, and the later cause as the "remote" excusable cause.

This is referred to here to illustrate how a navigator may be found in fault for delay and bad navigation, early in the positions shown on page 11, and the other navigator, not otherwise in fault, when forced to act through the pressure brought about by the prior fault, may be excused (under one of the forms of application of this principle) for an "error in extremis," as above explained.

This principle has been much confused and, indeed, abused in its application, because it is sometimes used in the alternative, but nevertheless improperly, with the principle of "primary fault, and immaterial error". But there need be no confusion when it is remembered that the "primary" fault is the *only* cause, and the "immaterial" error is *no* cause at all; the "proximate cause," on the other hand, is the starting or inducing cause creating the later cause which, although being very often the apparently sole cause, is, in fact, "remote," and excusable as an act "in extremis," or as an act produced by a species of force, or duress.

The following is the leading illustration showing how it is reasoned that the earlier cause is the sole "proximate" cause and the later cause is the "remote" and, therefore, excusable cause:

"A" threw a lighted squib from the street into the market house, where a large concourse of people were assembled. It was so thrown by "A" that it fell near "B," who, to prevent injury to himself and others, seized the lighted squib, and threw it across the market house, where it fell upon "C," who instantly, for self-preservation, seized it and threw it to another part of the market. It struck "D" in the face, and, then bursting, put out one of "D's" eyes. It was held that the originator, ("A"), of the train of connected and dependent circumstances was wholly responsible as the "proximate" and sole cause of the injury; the intermediate dependent causes were excused (in extremis) as "remote." (See Smith's Leading Cases, 11th Edition, Vol. 1, page 454.)

The above narrative so clearly illustrates this principle that it has been given with substantial fullness.

PRIMARY FAULT AND IMMATERIAL, INDEPENDENT, ERROR.

As has been seen, "proximate and remote cause" has frequently been confused with "primary fault and immaterial error," but the principles are radically different. "Proximate and remote cause" occurs only where more than one *cause* exists, the later causes growing out of and *dependent* upon the preceding one. (See *Proximate and Remote dependent cause,* page 43); as, for example, where a vessel, not otherwise at fault, is required to act hastily and commits (remote) "error in extremis," forced by the (proximate) prior fault of another.

But where there exists both a "primary" fault, and an "immaterial" ***independent*** error, the result is attributable solely to the ***primary fault.*** It is seen, that the immaterial fault is not related to the primary fault, and is in no sense a contributing cause; for example, where a vessel infracts a rule, but does not, in any sense, thereby contribute to the collision.

TYPES OF VESSELS, THEIR CHARACTERISTICS AND SPECIAL RELATIONS TO THE RULES:

STEAM VESSELS USING STEAM, OR OTHER POWER, COMBINED WITH SAIL POWER.

A steam vessel, under the rules (that is, any vessel operated by machinery), still retains her character as a steam vessel though she may have sails set in addition to her regular power, with the exception of motor boats ***between sunset and sunrise,*** referred to on page 56.

STEAM VESSELS USING ONLY SAIL POWER.

The rules of some localities provide distinguishing marks to warn other vessels when a steam vessel is using sail alone but has her funnel up. Such a vessel is a sail vessel, but without such marks an approaching vessel may take her to be a steam vessel.

When a vessel enters a situation with another vessel she must not (except where a departure from the rules is justified, see page 40) change from one power to another, or from one character of a vessel to another, until all danger is passed.

SAILING VESSELS.

The tack.—When a sailing vessel is "by the wind," confusion is constantly arising from misunderstanding of the tack a sailing vessel is on, when signals defining the tack are given or heard in fogs. One of the questions in the examination of navigators touches this point. Unless a navigator fully understands from the sound signals in a fog (which indicate whether the vessel is on the starboard tack or the port tack or running free, and how her sails may lie on her approach), he will not be fully prepared to apply the precautionary measures to avoid collision. This confusion has arisen so often and is so manifest in the examination of applicants for licenses, that it may be here stated that *a sailing vessel is on the starboard tack with the wind to starboard, and is on the port tack with the wind to port.*

The description of the tack first became established in connection with square-rigged vessels. They were on the port tack when the "port tacks" of her course lay inboard, and on the starboard tack when the "starboard tacks" lay inboard. In the modern schooner-rigged sailing vessel the tack of the main sail is at the lower forward corner.

Tactical maneuvers.—See *Tactical Maneuvers,* page 123.

Sailing vessels using auxiliary motor power, whose length exempts them from the motor boat rules.—If such a vessel is of such length as to be unaffected by the motor boat rules, she must be so equipped as to use all the methods required by the rules applicable to steam vessels when she puts herself in the steam vessel class by the use of auxiliary motor power, *and her auxiliary power and equipment must also be sufficient to enable her to comply*

with the rules applying to steam vessels. When under both sail and auxiliary motor power, or under her motor power alone, she is a steam vessel, ***both by day and by night,*** and must obey the rules applicable to steam vessels. It should be observed that although the length of such a vessel takes her out of the motor boat class, she is subject to the motor boat law relating to the method for extinguishing fire.

Such a vessel running under both sail and motor power may deceive an approaching vessel as to her character, and directly invite disaster. She should, therefore, be generous and ***prompt in giving signals,*** and should not wait until the approaching vessel (thinking she is a sail vessel, and therefore unable to give signals) approaches so near that a collision may be brought about. Signals will apprise the approaching vessel of her character, and prevent much of the misunderstanding which occurs.

The practice of using auxiliary power in addition to sail places upon such a vessel a grave responsibility to see that she uses the combined power with every possible safeguard surrounding her navigation, and, being a steam vessel in the eye of the law, ***she should be operated so that the approaching vessel may know she is a steam vessel*** (the sails being used only as auxiliary), and prompt signals should be given.

The uncertainty attending the use of both sail and auxiliary power is a strong reason against this practice.

When a vessel enters a situation with another vessel, she must not (except where a departure from the rules is justified, see page 40) change from one power to another, or from one character of a vessel to another, until all danger is passed.

FERRY BOATS AND PILOT BOATS.

What applies to steam vessels applies with equal force to ferry boats and pilot boats, but the rules of some localities provide exceptions, particularly as to the lights they are allowed to carry.

TUGS AND TOWS.

A tug and its tow are, so far as the observance of the rules is concerned, one vessel and are regulated by the same rules that apply to "steam vessels" without tows, some exceptions being made as to fog signals, lights, etc.

The tug is responsible for its own navigation and the general course pursued by the tow. A tow is not responsible for the faults of its tug, but is responsible for its own misconduct. A tow must, when the circumstances require, adopt every available means to avoid a collision, and where the tug obviously pursues methods which invite danger the tow should, when practicable, make formal protest.

The tow may be alone responsible for failing to follow, when practicable, in the wake of the tug, when the tow has a steering equipment, and it may be required to pay out, shorten, or cut the tow line to avoid collision. When a tow is not equipped with a steering gear, or when no one is placed in charge of it, the tug must exercise extreme care to see that the tow is kept on a proper course. The tow may be responsible for carrying improper lights, or for failing to give fog signals in the manner prescribed by the rules, especially when (on a long tow line or in fog, etc.) it is obscured from its tug or from the approaching vessel.

Long tows should have a prearranged method of signals (not in conflict with the rules) whereby the tug can be advised of the location of its tow in weather which obscures vision. But these signals should not be so used as to confuse other vessels.

Where a tug and tow are observed to be unwieldy and laboring under observable difficulties, a steamer free in her movements should, under the rule of "Special Circumstances," keep out of the way, though under ordinary circumstances a tug and its tow have no special rights over any other steam vessel.

Indeed, she has increased responsibilities with the knowledge of her own disabilities, and will not be excused for failure to seasonably obey the rules and adopt reasonable precaution. In passing tugs and tows, when there is risk of collision, it has been found cautious for steam vessels to reduce speed and to give ample room, and it may be necessary to stop the engines, and at times to reverse to kill headway. Being a steam vessel, a tug and its tow are required to keep out of the way of a sailing vessel. A tug with a tow should be liberal in the use of danger signals when its disabilities are not readily observable. A tug must cover its tow with every protection available. The tow must, except when the rule of "Special Circumstances" applies, follow in the wake of the tug. Negligent steering by a tow which permits a sheer from its course would absolve the tug, if otherwise free from fault. The tug is responsible for the movement of the vessel and all the parts of its tow, where there is no negligence on the part of the tow.

When there are two or more tugs at work on a single tow, the responsibilities are determined with regard to the negligence of the respective tugs, or together with the negligence of the tow, if any.

The rules as to ***speed, signals, lookouts, lights, and allowing ample passing room, and all other precautions,*** apply with as much force to a tug and its tow as to any other vessel.

Tow lines.—It is the tug's duty to see that the tow lines are of proper strength and are maintained at a proper length. The length of the tow line depends upon the number and condition of the tow, the weather, and the effect it may have in contributing to a collision. A tug with but one vessel in tow may, under the customary method of towing, use a longer line than would be permissible if such lengths of line would make an unreasonably long tow made up of several tow members. The members of the tow should, when practicable, protest against unreasonable or improper tow lines. The permissible length of a sea going tow line (sea fence) may be a negligent length to use in harbors, fairways, channels, or crowded waters. When the tow cannot be seen by approaching vessels at the time the tug can be seen, the tug is required to adopt all the precautions necessary to advise vessels of its tow's location, with the lights and signals prescribed by the rules. The uncertainty arises where the towing lights are seen and some of the tow members are observed, but the rear tow, being so far away, is first discovered after it has been determined that the entire tow has passed. The tow line should be reduced to a proper length in thick or nasty weather, or when coming to anchor, and all other reasonable precautions applied. Both the tug and tow should always be equipped with spare lines.

A special statute has been passed, and circular regulations have been issued, on the lawful length of sea going tow lines.

Towing lights.—Towing lights are white lights and are not to be confused with the colored side lights. They are fully described in the government rules. The *vertical* towing white lights must be carefully placed, one *above* the other, *strictly in accordance with the rules;* otherwise, if arranged horizontally, one or more of them may be concealed from view. *This is a very important rule and is constantly being violated.*

The provision covering the number of towing lights to mark the length of the tow should never be violated.

The rules prescribe the character, number, and location of lights for the members of the tow.

Lookouts.—The precautions as to lookouts, heretofore referred to, apply to a tug and tow and also to the individual members of the tow when the presence of a lookout is necessary to avoid danger. When the weather requires it, a lookout should be stationed in the stern of the tug as well as forward, for the tug is not alone obliged to shape her navigation for what is forward, but must be constantly on the alert to discover and remedy any difficulty which may arise with the members of her tow. (See *Lookouts*, page 22.)

Assembling the tow.—The responsibility for the arrangement of the tow, the strength and length of its lines, and the way they are attached, is primarily on the tug, but this will not excuse those in charge of the tow when they permit observable negligence in its arrangement, and, as a precaution, those on the tow should make formal protest if the tug is insistent on its negligent method. The tug can require the tow to be so arranged, in position, as to meet the requirements of navigation with which the tow is obliged to comply.

A tug is permitted to assemble its tow members in frequented waters only when compelled to do so and can find no safer place, but only on condition that ample room is left in which other vessels may safely pass. The tug and tow in the act of assembling are a vessel under way and are required to adopt all the precautions under the rules applying to moving vessels.

The tow must be assembled so that the members will not injure each other, and so that the tug lights or the lights of the members of the tow are not obscured. The rules define the various methods of arranging the members of the tow.

Towing in channels, rivers, or fairways.—When a channel, river, or fairway is used, the tug should use reasonable diligence to prevent obstructing it, taking care that other vessels may pass and be passed in safety. When it observes that there may be danger in passing, and it is proceeding against a strong current, it should stop in a safe place and wait for the vessel running with the current to pass. This also applies to the other vessel where it is running against the current and the tug or tow is running with the current. In emergency, and when it is practicable and there is time to do it, the vessel running with the current may avoid the tide taking it in hand by properly casting the anchor or anchors.

Unwieldy tows.—The fact that a tow is unwieldy and dangerous adds an additional burden to the navigation of the tug, requiring it to proceed more cautiously than otherwise.

A tow which conceals the tug's lights.—The tow is sometimes so large and so close to the tug as to conceal some of the tug's lights. The rules provide how the lights shall then be arranged. This situation requires the tug and tow to promptly warn approaching and overtaking vessels of their presence. This is more frequently a danger in overtaking situations. Where the tow is a sailing vessel, and her sails obscure the tow boat's lights, the sails should be lowered.

A tug which unnecessarily conceals a tow's lights.—Unnecessarily concealing a tow's lights is a fault when it contributes to a collision. Towing a vessel stern first when it misleads another vessel has been held to be a fault.

Sheer.—When a tug, close to its tow, backs suddenly, the quick water is liable to throw a tow in the opposite direction from that in which the tug is pulling. But the tug, by continually pulling, may stop the sheer. The greater the speed, and the shorter the hawser, the greater the sheer. Such sheers or yaws often occur on long hawsers when a tug lets up on its speed. (See *Sheer*, page 116.)

The tug's care of its tow.—The tug's duty to its tow is continuous from departure to destination. The tug must not, without permission, leave its tow between the starting and the ending of the voyage. If the situation requires leaving the tow or any part thereof at any point between the receiving and delivering point, due care must be taken to leave it in such a position that it may be protected from dangers, and that it may not do injury to other vessels.

Anchoring.—When anchoring, a tug and tow should seek regular anchorage grounds. When practicable they should avoid anchoring in fairways, on ranges, or in exposed waters. That it may be convenient to do so is no excuse. When required to anchor in channels and fairways, or near them, they should be moored parallel to the usual course of moving vessels, so that they may not shift their position, and ample passing room should be allowed on either side; and sufficient lights and sounds must be provided to warn vessels coming from any direction, together with any other aid required to prevent accident. (See *Anchoring*, page 76.)

An interesting chapter relating to towing is contained in "*Modern Seamanship*," by Capt. Austin M. Knight, U. S. N.

A TOW CONSISTING OF A VESSEL PROPELLED BY ITS LAUNCH OR TENDER.

It not infrequently happens that a sailing vessel draws her launch or tender partly aboard (astern) to sink its propeller, and is propelled by it in addition to the impetus derived by her sails.

Such a vessel is in tow and must see that regulation tow lights are set at night (between sunset and sunrise) and must so arrange in the daytime (between sunrise and sunset) to give prompt notice of her character to approaching vessels. The fact that the launch or tender is usually concealed at the stern adds to the deception of such vessels, unless the rules applying to tows are strictly followed.

Even under strict obedience to the towing rules prescribing lights and signals, the towing lights (which must be carried by the launch or tender astern of the tow) may be obscured by the sails or house of the tow, especially when observed from dead ahead. To avoid this deception, such tows should be equipped to give proper signals to approaching vessels and should ***promptly*** give them both by day and by night. Being a steam vessel in the eye of the law, such a tow is required to obey all the rules applicable to a steam vessel, and to give the signals required of steam vessels when towing. It should, therefore, not wait until the approaching vessel (thinking it is a sail vessel, and therefore unable to give signals) approaches so near that a collision may be brought about. Signals will apprise the approaching vessel of the character of the tow and prevent much of the misunderstanding which occurs.

The vessel towed in this situation should keep her own running lights properly displayed.

This method is often used when there is not the slightest necessity for it. It is usually a mere convenience to the sailing vessel and carries the gravest responsibilities in the event of collision.

Such a vessel accepts very grave responsibility to see that the combined power is used with every possible safeguard surrounding her navigation. The practice is a bad one, and should be discouraged as tending to deceive approaching vessels.

When a vessel enters a situation with another vessel she must not (except where a departure from the rules is justified, see page 40), change from one power to another, or from one character of a vessel to another, until all danger is passed.

MOTOR BOATS AND OTHER SMALL CRAFT PROPELLED BY MACHINERY.

The general navigation rules make it very plain that ***a vessel propelled by machinery is a steam vessel,*** and ***when propelled both by steam (or machinery) and sail it is also a steam vessel,*** and ***when propelled by sail alone it is a sail vessel.*** It is essential to get these fundamental distinctions firmly in mind.

Motor boats propelled by machinery or by sail alone.—*Thus, the collision rules and all precautionary measures applicable to a steam vessel apply to a motor boat propelled by machinery alone, and the rules and precautions applicable to a sailing vessel likewise apply when a motor boat is propelled by sail alone. There are some modifications of the rules relating to equipment in certain classes of motor boats.*

When sail and motor power is used in combination.—In the *daytime* a motor vessel (as described in the motor boat rules) under sail and also under auxiliary power is a steam vessel, but carries no marks, observable at a distance, to show that it is a steam vessel; and very often the approaching vessel (whether steam or sail) assumes from the appearance of the vessel that it is a small sailing vessel and regulates its navigation under the existing rules, only to find later that it is a steam vessel. A mix-up is often the result, especially in a situation where each considers the other the privileged vessel, and each has theretofore navigated as the burdened vessel; as for example where the burdened motor boat carries the approaching privileged steamer on her starboard bow and the steamer erroneously believes she is burdened to keep out of the way of what appears to be a sailing vessel, or where the burdened motor boat, acting as a steam vessel, tries to keep out of the way of the privileged sailing vessel, and the sailing vessel erroneously believes she is burdened to keep out of the way of what appears to be a privileged sailing vessel.

As a distinguishing mark to prevent this confusion, a motor boat under both sail and steam in the daytime (between sunrise and sunset) should be generous and prompt in giving signals. She should not wait until the approaching vessel (thinking the motor boat is a sail vessel and therefore unable to give signals) approaches so near that a collision may be brought about. Signals will apprise the approaching vessel that the motor boat is a steam vessel, preventing much misunderstanding. (See *Signals*, page 26.)

AN IMPORTANT EXCEPTION.

There is apparently an important exception (under the motor boat law as at present adopted) to the general rule that a vessel under combined motor power and sail is a steam vessel, which must ultimately be corrected by appropriate amendment to the act.

The exception relates to motor boats (within the motor boat rules) using both sail and auxiliary power *at night*. *At night* (between sunset and sunrise) the situation is very complicated. The motor boat rules require that a motor vessel, under both sail and motor power, shall not exhibit the white lights which she would be required to exhibit in addition to the colored lights had she not sail set. Notwithstanding she is using both sail and auxiliary power, which otherwise would make her navigate as a steam vessel, this provision, while it does not make a physical change of a steam vessel into a sailing vessel, apparently puts the motor vessel using combined power in the sailing vessel class, with respect to her navigation, between sunset and sunrise. Her navigation should, therefore, be adjusted to that of a sailing vessel, to avoid deceiving the approaching vessel. *It seems clear that having up only sailing vessel lights and giving notice that she is a sail vessel, as demanded by the rules, she must not act as a steam vessel.*

It seems safer at night, when under combined sail and motor power, to observe the rules applicable to a sailing vessel (the motor being used only as an auxiliary), *so the other vessel may understand by her action, course, and speed that she is a sailing vessel.* This is especially true in fogs or other heavy weather when (as a sail vessel) she is required to sound distinguishing signals indicating whether she is on a starboard or port tack, or running free.

There is no difficulty in remembering what rules apply when either sail or motor power is used alone; but when using both sail and motor power, it should be remembered that in the ***daytime,*** (between sunrise and sunset), being a steam vessel, ***she should be operated so that the approaching vessel may know she is a steam vessel*** (the sails being used only as an auxiliary power), and prompt signals should be given; but at ***night*** (between sunset and sunrise) ***she should be operated so that the approaching vessel may know she is a sailing vessel,*** the motor power being used only as an auxiliary. Any other method may imperil life and property.

The use of combined sail and auxiliary power directly invites disaster. ***The uncertainty which may develop is a strong reason against this practice. A motor boat should remain a steam vessel or sailing vessel, except in the most controlling emergencies, and when it uses both sail and motor power, every precaution should be used to avoid deceiving the approaching vessel*** complying with the rules; otherwise, the motor boat will be held responsible for the results following her deception.

Any vessel using both motor power and sail accepts a very grave responsibility to see that the combined power is used with every possible safeguard surrounding her navigation.

One unfortunate condition, growing out of the present law relating to motor boats, is that the operator is not required to pass the examination required of navigators of steam vessels. This often results in a distinct menace to the motor boat, its occupants, and to other vessels. The quickness of the motor boat's movements may enable the operator to overcome unskilfullness, and the motor boat may be nimble enough to get away, but the larger vessel may be drawn into collision with another vessel in seeking to avoid the prior risk; then the motor boat and the operator, if negligent, may be brought into that case to answer the results.

Then, too, the *"stand by"* rule (see *Duty After the Collision,* page 82) requires, in case of collision, that the vessels remain by to render all assistance necessary and to exchange names and port of register, or the port to which she belongs, and also the names of the ports or places from which and to which she is bound. ***Failing to do this, the vessel is presumed to be involved in guilt.*** The penalty for disobeying the stand-by rule is $1,000, or imprisonment for a term of not exceeding two years, and negligence causing loss of life may involve criminal proceedings.

It should further be noted that although the special statute provides additional rules for motor boats, ***they are still subject to the general rules of navigation when those rules are not in conflict with the motor boat rules, but, on waters governed by the International rules, the motor boat rules do not supersede the International rules.***

When a vessel enters a situation with another vessel she must not (except where a departure from the rules is justified, see page 40) change from one power to another, or from one character of a vessel to another, until all danger is passed.

ROW BOATS, OR BOATS OPERATED BY HAND POWER OR CURRENT, RAFTS, FLAT BOATS, SINK BOATS, &C.

Small boats, such as row boats, or boats operated by hand power or current, rafts, sink boats, etc., are regulated by special rules relating to lights, signals, etc.

Where it is observable, at a distance, that a row boat or hand power boat can meet its obligation to keep out of the way by a few strokes, the steamer or sailing vessel is not required to change its course and speed. The larger vessel must be on the alert to act promptly if emergency requires it. Such small vessels must, however, take into consideration their ability to maneuver more promptly than the large vessel which, under some circumstances, may be considered the privileged vessel. (See *Unencumbered and Encumbered Vessels*, page 39.)

When such small boats are in distress or encumbered, or where they show uncertainty of movement, the steamer or sailing vessel must keep out of the way.

Vessels which are moved only by the tide or current, such as rafts, sink boats, flat boats, and the like, must be avoided by a steamer or sailing vessel, or other vessels having better means of locomotion, if they can be seen with reasonable diligence.

All small vessels capable of being handled by oars must be equipped with them, even when they run usually under sail or other power, since they must carry and use these aids to avoid collision when necessary.

LAUNCHINGS.

In launching a vessel the utmost caution should be exercised, and advance notice must be given to owners and vessels in the vicinity. Picket boats should be stationed beyond the danger zone and be kept informed of all occurrences, to give prompt notice of danger, or to promptly notify others of any postponement, so that they may not be unnecessarily delayed.

A launching cannot be continued in the face of observable danger, but a vessel in the way must move when notified. After starting from the ways, and until her momentum is stopped, the vessel is privileged, and it may be left to her to enforce respect for her right of way. Tugs must, however, be in readiness to take her immediately in hand, and remove her to a place of safety.

The launch, and all vessels attending her, must carry the usual flags during the operation and take them in when it is finished or postponed. When it is customary for the Harbor Master to attend the launching, it should not take place in his absence.

(1) NAVIGATION IN FOG, MIST, VAPOR, FALLING SNOW, HEAVY RAIN STORMS, OR OTHER HEAVY WEATHER, OBSCURING VISION.

(See precautions under the respective headings.)

An apparently reliable definition of fog is given in the Century Dictionary and Encyclopedia, as follows:

> "The aggregation of a vast number of minute globules of water in the air near the earth's surface, usually produced by the cooling of the air below the dew point, whereby a portion of its vapor is condensed. The cooling may be the result of radiation, conduction, mixture with colder air, or ascension. Over surfaces of water warmer than the air, the fog, produced by cooling, is increased by the continued evaporation of the water into the already saturated air. Beyond the difference in the place of origin, there is really little or no distinction to be drawn between a fog and a cloud. A fog is a cloud resting on the earth; a cloud is a fog floating high in the air. (Huxley, Physiography, p. 44.)"

When warm air meets cold water condensation occurs in the warm air *near the surface*—usually termed *low* fog. When a cold air meets the warm water, as in the vicinity of the Gulf Stream, the phenomenon of *curling* "vapor" or "smoking water" is seen. This evaporation is much heavier and more perceptible than the still fog, and curls upward to a considerable height. It is very capricious, assuming many grotesque and fantastic shapes, the holes in it appearing as land or vessels, apparently close aboard. The strong cold wind, usually prevailing, makes this vapor vastly more dangerous than fog.

In fog, etc., strandings are always imminent, but then the movement of one vessel is the only factor. Collisions, however, are more to be feared, because the possible collision point is changeable and dependent upon the independent action of *two* vessels involved in *one* situation, and at all times the foundation is shifting and uncertain. When this demon of the deep plays blind man's buff, it is sufficient to strike terror to the stoutest heart.

Under the above conditions, it not infrequently occurs that the most intrepid navigator is put to a supreme test of courage, caution, and seamanship.

The mournful moan of the fog signal is a most uncanny sound to which the oldest mariner never gets comfortably accustomed; his respect for it is increased in proportion to his experience. The greater number of such collisions result from disobedience of the rules as to speed, lookouts, lights, failure to allow sufficient passing room, and fog signals. (See these subjects, pages 17, 22, 29, 33, and 61.)

Starting out, or moving vessels from berth to berth, in a heavy fog, mist, snow, or rainstorm, or other violent weather, may be a fault, unless public necessity requires it.

Heavy snow, rainstorms, or vapor are frequently accompanied by the additional danger of high wind velocity, and require even greater caution than fog.

Fog signals.—A neglect to promptly and regularly blow proper fog signals is gross fault. When it is observed that the fog signal required by the rules may not be heard, other additional means (which may not be taken for other signals prescribed by the rules) should be adopted to give prompt warning. Where those on a vessel hear a fog horn on another vessel, they are chargeable with knowledge of ***risk of collision;*** and even though her engine be stopped or reversed under the conditions prescribed by the rules, if she is allowed to drift and come into collision, she is in fault. ***Whether ves-***

sels are prohibited from blowing other than fog signals in a fog, when they are not in sight of each other, depends upon the rules affecting the particular locality. Under the "inland" rules, in fogs or other heavy weather fog signals are the only signals permitted until the vessels are in sight of each other, nor can any passing maneuvers be executed until passing signals can be and have been given and answered; but this is not the rule in some other localities. There is such difference in the fog rules for the various localities that it would be confusing to analyze them here—the rules of the locality must be studied on this important point.

The rules provide that fog signals of prescribed duration and intervals must be blown at stated periods during fog, mist, heavy rains, falling snow, etc., but they offer no explanation of the density of atmosphere requiring them.

Risk of collision, demanding the use of fog signals, may always be deemed to exist when the weather is thick enough to obscure safe observation.

It is usually safe (but not always necessary) to blow the fog signals when the condition of weather is such as to obscure ordinary running lights at the distance they are visible in clear weather, namely, ***two miles.*** It is prudent (but not always necessary) to blow fog signals when lights or objects customarily seen within a range of two miles are obscured. Due precaution may at times require them to be blown where the obscuration is less dense.

Periodic observation of the "whiskers" or "winkers" around the lights, or the distance objects show on deck, may, with experience, be a most valuable aid in ascertaining fog thickness, and its location, whether high or low, as among the guides to determine on signals and speed.

If a vessel is approaching or about to enter a fog bank or an obscured locality, or if it is skirting such a locality, all the precautions relating to fog signals, speed, and lookout should be applied, though the vessel itself may be in a clear atmosphere.

A steam vessel must use an efficient whistle or siren, sounded by steam or by some substitute for steam. A sailing vessel must use an efficient mechanical fog horn.

The rules, however, provide some exceptions, in the different localities covered by them, for certain types of small vessels, such as produce boats, fishing boats, rafts, coal boats, trading boats, canal boats, oyster boats, and other small craft ***navigated by hand power or current.*** Tugs and tows are specially required to blow signals defining their character; and sailing vessels indicate by specially prescribed signals how the wind bears on them. ***The rules for the locality must be consulted to determine what fog signal to give.***

The "Inland" rules and "International" rules permit different intervals between fog blasts.

Where the rules prescribe the length of blasts and the space between them, they should be accurately followed. Disobedience of this requirement is a cause of much confusion.

A steam vessel should carry a spare anchor bell, extra whistle or siren attachments, detonating device and fog equipment, all efficient and kept in good order for emergencies, and a sailing vessel should be equipped with a spare mechanical fog horn, anchor bell, detonating device and fog equipment, all efficient and kept in good order. Small vessels covered by special rules should carry an extra fog signal equipment, all efficient and in good order. All vessels should carry megaphones and use them when necessary. The voice, unaided by megaphone, may be heard in a fog a quarter of a mile away, in calm weather.

The submarine fog signal system is a great aid to the vessels so equipped.

(See ***Signals,*** page 26; ***Anchor Fog Signals,*** page 65, and ***Signal and Wireless Service,*** page 86.)

Speed in fogs.—An attempt to shorten the time of exposure in a fog by running at full speed can never be justified. The rules prescribe that the speed shall be moderate, having careful regard to the existing circumstances and conditions. The permissible speed is relative and changes with the conditions.

The law imposes on every vessel the duty of slacking speed according to the density of the fog and the difficulty of clear vision, even to the lowest point consistent with maintaining steerage-way. There is no absolute rule that a vessel shall "lay to" or anchor during a fog, but this is the precaution adopted by prudent navigators when conditions require it. It sometimes happens that a steamship may be navigating in such weather or in such a locality that she is better able to avoid collision when under steerageway than when at rest. Her duty in this particular, as in all cases, is a question of prudence under all the circumstances.

The test of moderate speed, in all cases, is the ability of the vessel to stop her headway in the presence of danger.

To avoid repetition, reference is here made to remarks under speed, page 17, which should be read in connection with this subject.

Stop! look!! listen!!!—This salutary rule on land, namely, stop! look!! listen!!! may be periodically applied to advantage in fogs.

Overlogging.—In a fog, as at other times when the log is used to determine distance, *overlogging* is a serious danger and is always to be apprehended.

Compass course in fog.—See *Dead Reckoning,* page 91; the *Log,* page 96, and the *Lead,* page 92. Also see the *Great Dangers in Failing to Allow for Leeway, Tide, Current, Swell, Set of Screw* (if a steamer) *Error in Steering, Compass Error, Deviation Due to Heeling or List, and*

Log Error, page 88; *Signal and Wireless Service,* page 86; and *False Departure,* page 89.

Anchor fog watch.—When a vessel is required to "lay to" or anchor during a fog or thick weather, in addition to the rules prescribed for lights, signals, etc., an anchor watch should be properly stationed to observe that the lights are *kept* burning, to notify approaching vessels to keep away, and to perform all the requirements stated under *Anchor Watch,* page 80.

When the vessel is equipped with wireless service, the dynamos should be kept in commission in the day time as well as at night. This new aid towards the avoidance of collision has many uses, and is advancing in favor among cautious navigators. (See *Signal and Wireless Service,* page 86, and *Anchoring,* page 76.)

Anchor fog signals.—See *Anchor Watch* and *Signals,* page 80, and *Anchor Fog Signals,* page 81.

Good lights, proper signals, a vigilant lookout, speed control, constant casting of the lead, with the application of good judgment in reading the chart, cover the essential safety methods in heavy weather and dangerous places.

See *Groping in violent storms or fogs,* page 65; *Atmospheric phenomena,* page 66; *Icebergs,* page 67; *Lookouts,* page 22; *Lights,* page 29; *Ample passing room,* page 33; *Departure from the rules,* page 40; *General Precautions,* page 9; *Crowded Waters,* page 70; *Anchoring,* page 76; *Practical Aids (Part II),* page 87; and all other subjects related hereto.

GROPING IN VIOLENT STORMS OR FOGS.

To grope for obscure aids in tempestuous, heavy, or hazardous weather invites danger. In violent storms, with a seaworthy vessel and a good coal supply and provisions, it is often safer to put to sea. Where headway cannot be maintained, the anchors may, when practicable, be used to aid her power in holding the vessel's head up. (See Anchors, page 77.) Drift from leeway, tide, current, swell, set of screw, error in steering, compass error, and deviation due to heeling and log error should always be ascertained, and due allowance made therefor. (See page 88.)

When the vessel is certainly being driven towards dangerous shoals or bottom in the teeth of her power and anchors, it may then be necessary to beach her, when practicable, in soft bottom, and in an unexposed place. A cautious master will confirm his judgment, in such final methods, by conference with the officers of the deck and engine room. In bad fogs, mist, vapor, falling snow, heavy rainstorms, or other heavy weather it is safer to anchor, when practicable, if a safe anchorage can be secured.

The constant use of the lead, correct reading of the chart and vigilant lookouts, proper signals, and control of speed are imperative. See ***The Lead,*** page 92; ***Lookouts,*** page 22; ***Fog or Other Heavy Weather,*** page 60; ***Atmospheric Phenomena,*** page 66; and ***Practical Aids (Part II),*** page 87 et seq.

ATMOSPHERIC PHENOMENA.

The atmosphere consists of layers or veins of different densities which are located either horizontally, perpendicularly, or at angles, or they may exist in patches or pockets. Experiments have demonstrated that sound will not always progress with equal strength or velocity from the center of disturbance. Sound, in a fog, is subject to reflection, refraction, and diffraction. The sound may go entirely over a vessel and be heard by a vessel farther away, or it may divide and go on either side of a vessel without being heard by those on it, or it may take an angle or curving course in any direction. The hearer may correctly locate the direction from which ***the sound comes to the ear*** and yet the source of the sound may be in another direction. *Lord Kelvin* ascribes this condition to fluctuations in atmospheric pressure and temperatures.

An aberration causing an error of 5 points has been noted.

It requires abundant caution to locate a fog signal or other aid, in a fog, vapor, heavy snow, rain storms, or other heavy weather, and to pick up a fog signal, or other aid, where it is known one should be located. ***It cannot be assumed that the absence of signals is an assurance of safety. In approaching dangerous localities, in thick fog, mist, vapor, snow or rain storm,*** or other heavy weather, ***the lead should be constantly used,*** and all other precautions should be adopted, ***as though no aid existed at that point, until it is definitely located.*** Standing back in the pilot house may greatly aid in hearing sound.

Fog, mist, vapor, rain, hail, snow, or other heavy weather do not alone affect sound. Its aberrations are often pronounced in the clearest weather.

The Government has issued a number of pamphlets calling attention to the subject of sound in fogs.

(See ***Fog or Other Heavy Weather,*** page 60; ***and Groping in Violent Storms or Fogs,*** page 65.)

ICEBERGS.

This subject is only important to a limited number of vessels which navigate in the locality where icebergs may be encountered. Icebergs do not constantly follow the polar current. They may be deflected by eddies and strong winds, and becoming detached from the usual drift, may wander aimlessly in any direction. They have been known to drift against a strong wind. It must never be assumed that the danger from collision with icebergs has passed until a wide margin of safety has been allowed.

The difficulty of seeing an iceberg is greatly enhanced by the character and quality of its substance, and though it be clear weather it may be very close aboard before sighted. Usually there is only one-quarter to one-eighth of an iceberg visible. They are liable to turn of their own weight. The danger of a vessel being crushed by overhead fragments, or by being lifted out of the water is always present. It, therefore, is needless to say that a very wide berth should be given them. Submerged icebergs may indicate their location by an unusual agitation of water in their locality. When in the customary path of these obstructions, vigilant lookouts may greatly aid by close attention to the surface of the water.

When approaching such localities, everything should be in readiness for *instant* use. *Icebergs are more to be feared than vessels, and in fog the greatest sea peril threatens.*

Thermometers to record temperature and hydrometers to measure sea density should be carefully used, and frequent tests made at the sea surface. In compliance with the precautionary rule of margin (see page 9), the records of the thermometer and hydrometer should be observed (as in throwing the lead) oftener than is absolutely necessary. *The point is to be sure.* It has been doubted that the thermometer or hydrometer is to be wholly relied upon. Indeed no one method should be relied upon. On the contrary, all other tests should be applied, but the failure of the thermometer or hydrometer to record the presence of icebergs may be due to infrequent observations; in such localities these instruments *should be continuously watched.* No set period for such examinations can be prescribed for all vessels. In determining the element of risk, the speed of the vessel, its power to stop its headway in the presence of danger, and the ability to see objects and hear sounds should be very carefully weighed. In fog *all hands* should keep a *sharp lookout* for "ice blink," the sound of "breakers," and "echo." At night, when fog signals are not required, a *sharp lookout* should be kept for "breakers" and "ice blink." The placing of as many experienced lookouts as may be necessary under the conditions, is peremptorily required, and the location of a competent lookout forward and in the crow's nest, with strong marine glasses, and with prompt means of communicating to the pilot house, should never be overlooked. The difficulty in hearing breakers and echoes requires that the lookout be screened from strong wind, which renders hearing difficult. The use of a sound signal (when fog signals are not required) has been suggested by navigators of experience, in order to get the additional aid of the "echo."

Under favorable conditions ***proper use of the searchlight*** may be an important aid. When searchlights are used, care should be taken not to blind observers on other vessels. The glare of lights forward (except running lights) should be screened to effectually see ahead. This will increase the ability to see in any weather, and will increase the efficiency of the searchlight.

Though it does not invariably occur, fog is usually to be expected in the vicinity of icebergs, and is due to the atmospheric conditions shown under ***Fog,*** page 60. The great danger in a fog is in miscalculating the course, and unexpectedly getting into or near the polar current where icebergs usually abound. (See precautions to be exercised under ***Fog,*** page 60.)

Since suction is due to displacement caused by an object moving through the water, it must be reckoned with in this class of collisions. (See the general theory of ***Suction,*** page 115.)

Extraordinary care should be exercised in the speed; and the ability of the engine room watch to act on the instant orders are transmitted is essential.

See ***Speed,*** page 17, ***Lookout,*** page 22, ***Searchlights,*** page 33; ***Signal and Wireless Service,*** page 86, and other precautions under the various headings relating to ordinary navigation.

On this point also see *"Wrinkles in Practical Navigation,"* by *S. T. S. Lecky.*

(2) NAVIGATION IN CROWDED OR FREQUENTED WATERS.

(See precautions under the respective headings.)

Situations are encountered in rivers, channels, slues, fairways, on range lines, and in harbors, where vessels may not always be seen, but may be constantly expected, which require judgment and resourcefulness. The rules apply usually to *two* vessels involved in *one* situation. The situation, however, may be complicated by the position of other vessels in either close or remote proximity, and, as to which, rules other than those governing the two vessels may have become effective. If these complicated situations were carefully noticed, it would be seen that other rules fall in and out, with regard to such other vessels, to which the two vessels, bound in "situation," must pay attention, and to which their navigation must be adjusted. It has been suggested that an independent flashlight be carried at the mast of steam vessels, to be flashed at the time signals are given, when, at night, it is impossible to determine which vessel is signalling. The Government has not yet granted permission to use this aid, but its use may be as fully justified as a search light, which is at present used without direct authority.

It cannot be too emphatically stated that, in so far as the two vessels in fixed "situation" are concerned, their relation as the "burdened" and "privileged" vessel continues in force, until a departure from the rule can be justified, or until they go clear.

Complications, brought on through the negligence of such other vessels, may require a departure from the rules (see

Departure, page 40), but such departure must be peremptorily required. Such complications, however, emphasize the requirement to exercise great prudence and caution, with the ability to control speed and helm action with the greatest promptitude and precision.

In crowded waters, the *willingness* to *promptly* give and answer signals is also very important (see *Signals,* page 26), though much alertness is required to avoid giving confusing signals to other vessels, which tend to throw doubt and uncertainty on the maneuver of the immediate situation.

Again it is to be noted that the effectiveness of any maneuver depends upon its *prompt* and *uniform* application. The promptitude in controlling speed and helm action and the use of proper signals usually exonerate the vessel exhibiting such caution.

It must always be borne in mind in channel navigation that a change of helm made too early may invite a sheer, and, if made too abruptly, or too late, may invite the "kick", when otherwise the vessels would go clear.

Every vessel with a pilot-house should be so arranged that an unobstructed view may be had of rear ranges. The observer should be able to stand as nearly on the keel line as the obstruction of the masts or smokestack will permit. The oversight in building obstructions to the rear view is frequent. It is dangerous when the navigator is required to continually go outside to observe rear ranges, for his attention is unnecessarily crowded with extra duties, the weather sometimes prohibits, and the angle of observation from the side may give an erroneous impression whether the range lights are open or closed. (See *Bearings,* page 128.)

The Golden Rule of navigation.—The Golden Rule is to *keep to the right.* This rule is generally applied as a preferential rule in all situations meeting end-on or nearly so, as defined by the rules, and it is accomplished, under the rule, by the exchange of signals of one blast each, whereupon the vessels pass port to port. But this does not change the obligation of a privileged vessel to hold her course and speed.

There are conditions in some "crossing" situations which prohibit the application of this rule, and, under a signal of two blasts from each of the vessels, the passage may be made starboard to starboard. In all instances, however, the passing vessels must indicate their intention, by the appropriate signal, and a clear understanding must be reached between them.

Starboard side of channel rule.—So, too, is this *Golden Rule* applied to steam vessels running channels, rivers, slues, or fairways. ***A steam vessel is required, when safe and practicable, to keep to that side of the fairway or mid-channel which lies on the starboard side of such vessel.*** When it is safe and practicable, a privileged sailing vessel might, with advantage, do likewise; but this should not interfere with beating out the tack, or cause any change in its course and speed. When running free, a sailing vessel complying with this reasonable precaution may, when it is practicable, avoid the risk of collision by keeping out of the waters used by vessels coming from the opposite direction. There seems to be no good reason why this precaution should not be required of sailing vessels, as a matter of safe seamanship, when it is practicable.

It should be observed that this rule is not of force when it is ***not safe or practicable*** to apply it, nor is it expected that it be applied under a mathematical calculation of the ***exact*** center of the channel. Like all rules it should be reasonably interpreted.

This rule does not mean that, in the face of interfering conditions such as thick weather, the center of the channel shall be determined with exactness; this would often be impossible of exact ascertainment. It means that vessels must, when they can do so, keep well over on their own proper side and shall not encroach on the far side of the channel which lies on their port hand, as not to leave ***ample*** room for vessels complying with the rules and good seamanship to pass.

It has been held in some decisions that the starboard side of the channel rule is not intended to apply in harbors where the nature of business requires vessels to alternately work on either side, but it should be honored there when it is ***safe*** and ***practicable.***

There are conditions in some rivers with strong currents, which make offsets from the points into the opposite bites, to which this rule cannot with safety be applied, and the vessel moving against the tide should then wait until the vessel on the tide clears the current at the bends and takes her proper side in the straight reaches.

Some rivers are covered by special statutes defining the exact waters descending and ascending vessels shall use, but these are the outgrowth of special conditions which prohibit the application of the starboard side rule.

Getting under way.—In the application of the rules, a vessel getting under way (after letting go) is deemed a vessel fully under way, and should use every precaution of navigation to prevent collision. Its relation to vessels at anchor or moored nearby is that of a moving vessel, and its relation toward moving vessels is governed by the regular steering and sailing rules.

When a vessel is about to leave her berth, slip her moorings, or weigh anchor, she must warn other vessels which may be in the vicinity and unseen, and she must adopt all the requirements provided for moving vessels. (See ***Alarm Signals,*** page 29.) She is required to foresee the results of leeway, tide, current, swell, and other interfering conditions, and to use proper warp and stay lines; and sailing vessels may also be required to use their head sails to assist the helm. ***The speed must always be such as to be under complete control*** when misunderstandings, in steering, in the engine room, or in handling lines, occur.

As in docking, mooring, or anchoring, precaution is summarized in two words: *Maneuver slowly.*

Testing the engines, preliminary to getting under way, must be accomplished without danger to surrounding vessels. Especially should it be observed that no vessels with dangerous lists are within the range of the suction, wash, or swell. (See *Docking and Making Moorings or Anchorages,* page 78.)

Approaching or leaving slips or wharves.—The moving vessel is charged with a heavy burden with relation to vessels not under way, and should navigate near slips or wharves with great caution to prevent damage from wash or suction. Vessels not under way must render reasonable facilities to allow another vessel to enter, and must be equipped with and put into use buffers, or fenders, to assist in preventing damage in close quarters. Vessels should not attempt to leave or enter a crowded slip when another is undertaking to do so. Here the first moving vessel has, in a sense, the right of way to enter or leave, and others should keep out of the way by holding their position until their turn has come. In emerging from a slip by means of stay lines a vessel will reach a point where she is in a sense helpless. She should anticipate this by giving prompt notice of her disability and be prepared to otherwise control her movements. Approaching vessels are obliged to observe this condition and to keep a safe distance away. All vessels should be equipped with proper lines, and they should be freely used to control momentum. The strength of wind, tide, current, swell, and other interfering conditions must be guarded against. Harbor master rules usually govern and facilitate vessels in seeking their rights in this situation. (See *Getting Under Way,* page 73.)

Concealed vessels.—Where wharves or other obstructions, or bends in channels are liable to conceal vessels, great care must be exercised in the navigation, and in giving the *alarm* signals. (See *Alarm Signals,* page 29.)

The current in rivers, channels, and fairways.—The vessel running against a strong current should always be on the alert for a vessel running with the current, as the latter may have more difficulty in maintaining her position. It often occurs that the sweep of the current does not permit the vessel running with it to regulate her speed lower than safe steerage way. It is incumbent on the vessel running against a strong current to note these difficulties, and to safeguard her position and speed, even if it be necessary to stop in a safe place until all danger is past. In emergency, when there is danger of going ashore, the vessel running with the current may, when safe and practicable, properly cast her anchor or anchors, but her failure to do so will not excuse the fault of the other vessel.

Crossing anchorages.—Crossing anchorage grounds should be accomplished with the utmost care, and the precautions, herein stated, in respect to navigation in other dangerous places, should be applied.

The berth.—The location of a vessel at its berth is not an absolute right when others have a right to berth above or below it. When she has notice of the dangerous approach of another seeking her rights to her own berth, she must be prompt and vigilant in all reasonable endeavor to avert danger, and render prompt aid by the use of buffers or fenders. Proper caution requires that vessels in berth be lighted when lights would aid in avoiding danger, and if the location is a dangerous one the fog bell and sea watch may be required in heavy weather. The berth should be so selected, and lines applied, that the movement of the vessel in her berth, caused by a rising or falling tide, or swinging from wash, swell, or suction may not produce injury to herself, or to adjacent vessels, or foul their hawsers. (See *Anchor Fog Signals*, page 81.)

Unlawful berths.—The selection of an unlawful place to berth, while not necessarily a cause contributing to the actual collision causes, may in some instances be a fault contributing to the damage. (See *Anchor Location*, page 76.) The moving vessel, however, may not rely upon this to absolve it from fault.

Lines and fastenings.—Close attention to the lines is necessary to see that they are in good order, well attached and taut, to prevent breaking loose, and to prevent too much movement of the vessel at the risk of danger to herself or to others. The lines should not bind or hold the vessel when rising and falling with the tide. When breast or other lines are liable to produce dangerous lists on the rise or fall, a watch should be kept over them. Where the cleats, piles, or other fastening devices are defective, they should be promptly reported to those in charge.

See also *Speed*, page 17; *Lookouts*, page 22; *Signals*, page 26; *Lights*, page 29; *Ample Passing Room*, page 33; *General Precautions*, page 9; *Departure from the Rules*, page 40; *Fogs, etc.*, page 60; *Atmospheric Phenomena*, page 66; *Anchoring*, page 76; *Practical Aids (Part II)*, page 87 et seq., and all other subjects related hereto.

(3) ANCHORING, MOORING, AND DOCKING.

(See precautions under the respective headings.)

Location.—When sudden exigencies require it, as an unexpected fog, violent storm, etc., a vessel may anchor where controlling conditions overtake her, *providing she uses precautions adequate to her exposed position, and providing she moves from such exposed position immediately on the discontinuance of such controlling conditions;* but this will not permit a vessel to take a hazardous anchorage if she has any means of getting to a safer anchorage. *Her own convenience is not accepted in justification of the danger she*

provides for others. If she is anchored in a fairway, and the close approach of other vessels using the fairway may add increased burdens, she must, when practicable, abandon that position, if, by local information, observation, soundings, and the chart, safer anchorage may be secured. A vessel should seek a safe position in preference to remaining where she is a menace to herself and to other vessels moving along customary courses, or on established range lines.

It is not overlooked that the moving vessel has frequently been held solely in fault on the ground that its fault was the "primary" cause of the collision. (See ***Primary Fault and Immaterial Error,*** page 44), but a distinction between negligent acts causing a collision and negligence causing loss is now being announced by the courts, and though no act of the improperly anchored vessel may have caused the collision, yet her negligent location may, in some instances, be held to have contributed to the damage.

Precautions.—The strictest observance of the statutes in every other particular will not relieve the anchored vessel of failure to adopt extra precautions equivalent to the exposure of the position. An unlawful anchorage berth, or mooring, added to any other slight neglect will visit severe penalties on a vessel which might otherwise escape the imputation of fault.

The safest plan is to anchor on approved anchorages or away from the customary track of vessels.

The anchors.—The use of all necessary anchors is decided by the exposed position. In heavy storms or floating ice, strong currents, etc., both or all anchors should be used when necessary. In narrow channels, narrow streams, rivers, or fairways, the stream anchors should also be used, to keep the vessel parallel with the trend of the passage or fairway, and to prevent obstruction due to tailing on wind or current. ***All anchors must be ready for immediate use.***

Carrying anchors suspended at the hawse pipe, when not absolutely required, is a dangerous practice.

In equipping a vessel with anchors, great care should be exercised to provide *ground tackle sufficient to hold in violent storms* and equipped to cast promptly. Vessels have been caught in gales which drove them ashore against the combined influence of all their anchors and their power.

Approaching the anchorage or mooring.—A vessel should, when practicable, have a tug or tender ready to assist in anchoring, when necessary to avoid collision. Delaying until night, when the anchorage could have been made in the day time, may also be a fault.

Docking and making moorings or anchorages.—The speed in approaching an anchorage, a dock, or a mooring place must be promptly regulated. It not infrequently happens that orders or signals to the deck watch or engine room are improperly given or misunderstood. *The vessel, therefore, should never be under more momentum than can be immediately checked.* All vessels are required to foresee the results of wind, leeway, tide, current, swell, and other interfering conditions, and to use proper warp and stay lines (bow, breast, spring, or stern lines), and to warn other vessels in the vicinity. A sailing vessel should shorten sail before bringing up in a crowded roadway.

Here precaution is summarized in two words—maneuver slowly.

The maneuvers relating to docking are carefully considered in "*Modern Seamanship,*" by Capt. Austin M. Knight, U. S. N., and "*Luce's Seamanship,*" revised by Ward.

Anchorage berths.—Sufficient distance from other vessels should be allowed in anchoring. When tailing it should be so arranged that ample room may be allowed for vessels to pass at all times. Where for any reason the location of the anchorage cannot be changed and the chain or cable cannot be sufficiently lengthened or shortened to allow good passing room, stream anchors should be used in addition to the regular anchors, to moor the vessel in the least exposed position.

Anchoring in channels.—The rule "that it shall not be lawful to tie up or anchor vessels or other craft in navigable channels in such manner as to *prevent* or *obstruct* the passage of other vessels or craft" *is best interpreted by selecting a place to leave no room for doubt.* The words "*prevent*" and "*obstruct*" are to be interpreted as the clear way *appears* to a cautious navigator when approaching. Cautious judgment may *prevent* passing on one side, although there may, in fact, be room to squeeze by, and a vessel may be *obstructed* by an apparently safe distance, made dangerous by an unavoidable sheer.

The allowance of ample passing room by the anchored vessel, and the proper control of speed and helm by the moving vessel, are the essential safeguards to be applied.

Depth and tailing.—In anchoring, always allow for effect of wind, tide, current, and swell, when tailing, and select sufficient depth to be afloat at low tide.

Anchor record.—*Never omit "fixing" position by sounding, and when practicable take cross bearings. The anchor watch should keep a careful record of bearings when position is shifted in tailing or dragging, and of the direction and strength of current, and promptly notify the officer in charge, of observable danger. A drift lead may aid in these observations when bearings cannot be watched. A record of the bearing of other vessels may be of value if fog shuts down, for, in case of accident, they can be more readily reached.*

Anchor lights.—The exhibition of anchor light or lights (otherwise called riding lights) so constructed and situated that it, or they, may show a clear uniform and unbroken light visible all around the horizon, at a distance of at least one mile (whether the vessel be situated in an exposed or an unexposed place), from *sunset* to *sunrise*, is imperative. A moving vessel will not, however, be wholly absolved from fault when in collision with an anchored vessel, even though there be no anchor light, if by the exercise of ordinary vigilance she should have seen the anchored vessel. The unobstructed white light or lights are prescribed for all vessels at anchor, the size of the vessel regulating the number and power. (See *The Berth*, page 75.)

Anchor watch and signals.—In addition to anchor lights, an anchor watch of one or more men, as the circumstances may require, is necessary in dangerous places. While the anchor watch is not an obligation imposed by the rules, the courts have held it obligatory, on the ground that vessels should take such other precautions, outside of the rules, for self-preservation, and to protect others, as the circumstances may require. An anchor watch, to observe the lights, is prudent at *all* times. It is the safest rule to keep a regular sea watch on duty when in an *exposed place*, or during *nasty weather;* as, for example, an officer in pilot house; a quartermaster to see to the sounding of fog signals, if there be fog, or to attend to the helm when changes of positions are required; a lookout forward and aft to watch lights and report approaching vessels; seamen ready to slip or let out or haul in chain; an engineer on duty, to be ready in any emergency, and the dynamos kept in commission for wireless communications, when the vessel is so equipped. Any other reasonable precaution should be observed.

Even when a full sea watch is not on duty, the anchor watch, in addition to observing the lights, must keep a close watch for other vessels, and be prepared to sound fog signals if fog or thick weather occurs. In a fog he must regularly give approaching vessels warning signals with the bell (or by the signal specially prescribed by the rules for his type of vessel), and by additional notice, not in conflict with the rules, as may aid in avoiding collision. Where the bell is not sufficient, other warning, not in conflict with the rules, should be given, but the bell should, in addition, be also regularly sounded under the rules. Precaution should be taken to let out or take in chains or cables, as the vessel changes its drift on wind or tide, to allow ample passing room, and he should watch all anchors or moorings. The watch should be provided with the facilities to take in or to let out or to slip chain in the presence of immediate danger, if by doing so a collision might be avoided. When required, effective means by megaphone, or otherwise, in addition to the bell, should be liberally used by the anchor watch to assist other vessels in keeping out of the way. The unaided voice may be heard, in calm weather, a quarter of a mile away. Care should be used not to confound additional anchor signals with others prescribed by the rules.

The same precautions apply to vessels aground, and, in addition, they should display the special lights and signals required by the rules. (See *Anchor Fog Watch,* page 65.)

Anchor fog signals.—The anchor fog signal is given by a bell on all anchored vessels, except where the rules in certain localities make explicit exception for certain vessels principally to show their position in rivers. Under the "International" rules a drum may be substituted for the bell on Turkish vessels designated by the rules. (See *Anchor Watch and Signals,* page 80, and *Getting Under Way,* page 73.)

HELPLESS VESSELS.

Aground, or when in motion but not under control.—A vessel in motion must keep out of the way of a vessel aground. This, however, does not relieve the vessel aground of the exercise of every precaution imposed upon vessels at anchor or made fast to the shore, and she should use the additional lights and signals prescribed by the rules. In fogs, or other heavy weather, great care should be exercised, because a grounded vessel is unable to take in, let out or slip chains, or to assist in any maneuver to avoid collision. A vessel negligently put aground may be held in fault for the same reason a negligent berth or anchorage may, in some instances, involve a vessel. (See *Anchoring location*, page 77.)

The rules prescribe special methods to notify moving vessels that the vessel is aground and helpless, or when she is moving but is not under control.

DUTY AFTER COLLISION.

Rescue.—It may be a mistake to draw out of a collision contact too soon. Many lives have been saved by stopping the engines from backing, and, if necessary, by putting the engines dead slow ahead to hold the vessels in contact until rescue has been accomplished. In addition to the adequate life-saving equipment, every vessel should carry several life buoys with an independent lighting attachment to float some distance from the buoy, which will stay lighted at least half an hour at night, or a marker by day, all kept in good order and available for instant use. When this cannot be provided, the life buoys should be kept painted with prosphorescent paint.

The details of life-saving drills are not a part of the subject treated in this manual.

Inspection and stand by.—After a collision has occurred, and the safety of the vessel is assured, assistance should be extended by a vessel, provided it can be given without inviting greater danger to the lives on board. The names of the vessels, and their home ports, and the point of origin, and destination should be interchanged. If this is not done, the vessel failing to give this information and assistance, when needed, is presumed to be the cause of the collision, and the navigator may be fined or imprisoned.

Permanent abandonment.—In a technical sense, abandonment relates to an abandonment to underwriters, and a claim for total or constructive loss. This can be done only by prompt and proper notice to underwriters. And there can be no technical abandonment when, by reasonable diligence or at reasonable expense, the vessel can be repaired and put in her former condition. Abandonment is, however, here used in the popular sense, and may sometimes occur through negligence in failing to properly mark, buoy, or light a wreck, or where owners fail to give proper notice, as required by law. In this popular sense a vessel must not be abandoned, and left a menace to navigation, when she can be removed and repaired at a reasonable expense. (See *Special Reports*, page 84.)

Temporary abandonment.—In the event of a forced temporary abandonment, with the intention to return, as where the vessel has been run to harbor, anchored, grounded or beached, and a new peril overtakes her, the house flag or private signal of the vessel should, when practicable, be raised, and, where there is no house flag or private signal, the national flag may be used to show that possession is not waived. This may have a bearing if salvage operations have been commenced by others. Abandonment is not used here in the sense of a technical abandonment to underwriters.

Regular reports.—The customary official reports should be made to the government officials, such as the report to the local inspectors, the government wreck report, etc., and a simple *note* of protest should be made. The *extended* protest, containing the details, can be made at any future time, when insurance is involved.

In addition to this, a detailed report of the collision should be sent to the owners. Short statements, signed by all those having knowledge of any fact bearing on the collision, are usually very helpful. When practicable, all vessels should carry regular report forms, to avoid overlooking information needed by owners to protect their interest.

Special reports.—The District Lighthouse Inspector should be immediately notified, by wireless or telegraph, of dangerous wrecks and unattended stranded vessels and, in addition, it is always prudent to notify the Commissioner of Lighthouses at Washington, D. C. The captains of the vessels (both vessels in case of collision) should also see that the vessel (if a menace to navigation) is marked properly, until the government has assumed charge.

COLLISION DAMAGES.

Limited liability.—It should be remembered that an owner's liability (if the owner is without *privity* or *knowledge* of the causes leading to the disaster) is limited, under the statute at present prevailing, to the value of the vessel after the collision, and the freight earnings then pending.

Since large vessels are usually of sufficient value to cover all damages in collision with smaller vessels, the smaller vessel has a greater degree of protection, while the larger vessel is sometimes unable to recover its damages, *even when free from fault;* thus, for example, the smaller vessel may be wholly at fault, yet, if it is a total loss, the limitation of the owners' liability to the value of the smaller vessel will prevent recovery from them.

Claims, other than those of the colliding vessels, may be laid against either vessel, and the more valuable vessel may be required to pay such claims without being able to find relief against the other vessel partly at fault, but whose value is low, or which is a total loss. This handicap on the more valuable vessel adds additional responsibilities to its navigator.

Divided damages.—The courts do not inquire into the degree of fault. If one vessel, by the ***commission*** of gross faults, collides with another, which has simply ***omitted*** to comply with a reasonable requirement, both vessels are, in the eye of the law, ***equally*** at fault, and the loss is apportioned equally between them. The necessity for ***prompt*** compliance with the rules and precautions suggested by good seamanship is therefore apparent.

Effort is now being made, in international maritime conferences, to establish the rule of ***comparative liability***, i. e., liability based on the ***degree*** of fault.

(See ***Inevitable Accident*** and ***Inscrutable Cause***, page 5.)

Surveys and Repairs.—Surveys of the vessel should invariably be made, giving all interested therein due notice and opportunity to join in the survey. Repairs should be ***promptly*** made, under competitive bids, at the lowest fair cost and least delay, for the benefit of "whom it may concern."

Total loss, actual or constructive.—Such complicated questions arise at a time when full advice can be secured.

DERELICTS, ETC.

All derelicts and dangerous floating wreckage should be reported to the Revenue Cutter Service, Washington, D. C., or to the local address of the service given in the circulars issued for this purpose; and all irregular, misplaced, or shifted buoys or other aids to navigation, should be reported to the District Lighthouse Inspector.

SALVAGE.

Salvage operations should be encouraged by reasonable reward, as an incentive to risk, and as a means of clearing waters of dangerous derelicts, but it should not be so large as to be a cruel burden to the unfortunate. Salvors should place their representatives aboard the salved vessel when practicable, and should remove them when it is safe to do so, to avoid unnecessary expense, but only under written agreement that salvage compensation is not waived.

SIGNAL AND WIRELESS SERVICE.

When the vessel is so equipped, the wireless service should be generously used to keep in touch with others, especially in fogs and heavy weather and should be used, when available, to give to owners preliminary notice of the substance of above reports. It has been suggested that the wireless call of the vessel be periodically sounded as an additional aid to fog signals, and the position and course of approaching vessels be ascertained. The intensity or strength of the answer may aid in approximating distance when the receiving operator is familiar with the sending equipment.

The wireless service should be ever on the alert (as in the case of a lookout) for purposes of aid to the vessel or to others in distress. Tuning for long and short distances should be made in periods not longer than fifteen minutes apart.

Wireless service should be kept continually in commission (termed "watch and watch") even when necessary to supply power by an auxiliary engine.

Foreign countries require their merchant marine to be familiar with the code signals. Whether this be required by the Government or not, all young men of ambition should become familiar with the Morse and Continental Codes, and with signals, as applied to lights, sound, marks, or flags. A man showing such helpful ambition and capacity to signal in an emergency may be sure of advancement. (See diagram of wireless signals on opposite page.)

WIRELESS CODES

LETTERS	MORSE	CONTINENTAL
A	• —	• —
B	— • • •	— • • •
C	• • •	— • — •
D	— • •	— • •
E	•	•
F	• — •	• • — •
G	— — •	— — •
H	• • • •	• • • •
I	• •	• •
J	— • — •	• — — —
K	— • —	— • —
L	——	• — • •
M	— —	— —
N	— •	— •
O	• •	— — —
P	• • • • •	• — — •
Q	• • — •	— — • —
R	• • •	• — •
S	• • •	• • •
T	—	—
U	• • —	• • —
V	• • • —	• • • —
W	• — —	• — —
X	• — • •	— • • —
Y	• • • •	— • — —
Z	• • • •	— — • •
&	• • • •	
1	• — — •	• — — — —
2	• • — • •	• • — — —
3	• • • — •	• • • — —
4	• • • • —	• • • • —
5	— — —	• • • • •
6	• • • • • •	— • • • •
7	— — • •	— — • • •
8	— • • • •	— — — • •
9	— • • —	— — — — •
0	———	— — — — —
.	• • — — • •	• • • • • •
,	• — • —	• — • — • —
?	— • • — •	• • — — • •

WIRELESS ABBREVIATIONS.

G E—Good Evening
G N—Good Night
G M—Good Morning
G A—Go Ahead
O S—Ship Report
D H—Free Message
M S G—Message
O P R—Operator

4—Please Start Me, Where
13—Understand
25—Am Busy Now
30—No More
73—Best Regards
77—Message For You
92—Delivered
99—Keep Out

DISTRESS SIGNALS.

S O S MORSE

C Q D CONTINENTAL

PART II.
PRACTICAL AIDS.

The points here referred to are not covered by the rules designed to prevent collisions, but they are intimately related to this subject.

These aids seek to offer safeguards touching system and safe methods. They are, in the main, the outgrowth of the experience of trained and skilful navigators. No effort is made to cover the entire field of navigation; on the other hand, it is aimed to do here what has been attempted in Part I, namely, to briefly present the most prominent precautionary aids relating to ***collision.*** Some allied subjects are also referred to, all having a bearing in a direct or remote way on the avoidance of collision. They do not conflict with the rules, but, on the contrary, cover a great many points relating to collisions, and, incidentally, navigation relating thereto, the knowledge of which is essential.

The accuracy of the vessel's position is closely related to collision. As position must be covered with such detail, the suggestions herein may also aid in preventing ***STRANDING,*** in which position is the chief factor.

Without diverting from our subject, we may refer to the method of securing ***position,*** and the method of taking ***departure,*** since accuracy in the course "made good" is often important in fixing blame for collision.

The ship's ***position*** is the one controlling point. If this could be definitely determined at all times, navigation would be an exact science; but in the nature of things this cannot be always relied upon, and reliance must be placed on the careful ***judgment*** and ***skill*** of the navigator.

Position is "fixed," on the one hand, (1) by *land* and *bottom,* known as *pilotage,* the means used being the *instruments, chart* and *lead,* and sight of *terrestrial* objects, such as headlands, lightships, lighthouses, buoys, etc., and (2) by *dead reckoning*—i. e., a calculation ("the day's work") from former position, the means used being the *log, compass* and *chart;* on the other hand, (3) by *celestial observation* and the instruments applicable thereto. The calculation necessary under the third method requires the application of pure geometry and astronomy.

The most reliable methods, when available, are the first method, by *land* and *bottom* (Pilotage), and the third method, by *celestial observation.*

In thick weather dependence on dead reckoning is the only guide, *with the lead or sounder as the chief detector of danger.*

Even when the position is accurately determined, there are elements present which must be resolved on the safe side to determine where a vessel will ultimately "fetch up" on distance runs on a given compass course.

The most important elements for which allowance must be made are **leeway, tide, current, swell, set of screw (if a steamer), error in steering, compass error, deviation of the compass due to heeling or list (see Compass,** page 97,)**, and log error.** Some of these deflecting influences are treated hereafter in the order of their importance. Full allowance must be made for them, *and also for the possibility of a false departure,* in setting and steering courses, *and tests by soundings for present location should never be neglected.*

The most skilful navigators often rely upon their ability to find their position properly and to shape their course accurately, placing reliance in their thorough knowledge of customary methods, but an unknown current, or a compass error which has not been tested out, or failure to anticipate outside conditions, may upset the best calculations.

The navigator of less experience often avoids difficulty by the free use of testing methods, particularly the lead, and escapes disaster which overtakes the mature methods of a skilful navigator who relies altogether on the usual methods but fails to apply confirmatory tests.

The frequent and liberal use of the deep sea sounder or lead is absolutely imperative to test position, even under the most accurately applied methods.

THE DEPARTURE.

In deep sea navigation the ***departure*** is the first "fix" of the ship's position when shaping the first course and commencing the log.

In coast and inland navigation, where dead reckoning is not so frequently used, each position from which the course is shaped is termed a departure. It will be used in this sense in this manual.

FALSE DEPARTURE.

A departure is rarely taken from an accurately "fixed" position, so that small cumulative mistakes occurring in a number of false departures, unless constant tests for position are made, may make a very decided difference in the end. The interferences named on page 88 must always be reckoned with in these calculations.

In "dead reckoning" it is not expected to do much better than to be within sight of the accurate position. Notwithstanding the great value of the lead or deep sea sounder, ***great care must be used to accurately locate reported depths on the chart.*** The danger lies in fixing the course from an assumed place on the chart when the vessel is in fact departing from another locality. In a dead reckoning, and where the depth will permit, the lead or sounder is the main aid in testing the position found by course and distance, but even then the chart usually shows a zone of equal depths in the locality, and the vessel may be in that part of it which will cause the vessel, on the adopted course, to "fetch up" in the wrong place. Some of these zones of equal depth are seen to be miles in area, and while a departure may be safely made from one part of the zone, a departure taken from another part (on the same course) may lead to disaster. A safe method is to keep off until a safe departure can (without doubt) be determined, or, in doubt, to set a course in which all doubts are resolved on the safe side, and ***ample safety margin is allowed.***

Even though a vessel may be off her usual course under these circumstances, she will not be charged with fault in event of collision, if she has used care, diligence, and skill in these respects. She must adopt her usual departures and keep her usual course, when practicable, because other vessels have become accustomed to find her there.

Remember the lead.

THE SAILINGS.

The deep sea navigator has two tracks from which to choose: Rhumb sailing or Great Circle sailing.

The methods of pursuing the tracks are: Plane, Traverse, Current, and Spherical sailing; including Parallel, Middle latitude, Mercators, and Great Circle sailing; or Composite sailing, which is a combination of Parallel and Great Circle sailing. But the object of this manual forbids taking up subjects relating solely to navigation. These points are ably presented in the works referred to in the foreword to the second edition, and in the works shown in the bibliography in the appendix.

For a handy pocket edition, and quick reference, much valuable information may be obtained from Bedford's ***"Sailors' Pocketbook,"*** and the ***"Navigator's Pocketbook,"*** by Captain Patterson.

DEAD RECKONING.

Dead reckoning has been condemned by marine writers and navigators of experience, except where it is the only method available, because of the great uncertainty in the distance covered, and greater uncertainty in the actual course made, both of which are rendered doubtful by interferences always tending to change the ship's position; furthermore, the departure or departures may not have been very accurately determined. The combined error of all these elements, though slight in any one instance, may, without proper allowance, give an entirely erroneous position when laid down on chart. ***Here the great aid—the lead or sounder—comes in, when practicable.***

When dead reckoning must be used, speed and direction should be safely discounted in ***the allowance for log errors, and the interferences mentioned*** on page 88, ***and frequent tests by soundings, when practicable, should invariably be made.*** As soon as correct bearing by land, bottom, or celestial observation can be secured, the true position should be determined, rather than the approximated position on a dead reckoning, and all known tests for position should also be applied, ***never neglecting the lead or deep sea sounder,*** when practicable.

A reliance on dead reckoning without familiarity with, and application of, scientific or other reliable means, when possible, is inexcusable in the modern navigator.

Lecky quotes with emphasis the following observation by *Sir William Thompson* (*Lord Kelvin*) on this subject:

"Writing about logs and leads naturally leads to the subject of Dead Reckoning. Lord Kelvin, in his 'Lecture on Navigation,' has put the matter so clearly and forcibly, that one cannot do better than quote his words. He says:

> 'When no landmarks can be seen, and when the water is too deep for soundings, if the sky is cloudy so that neither sun nor stars can be seen, the navigator, however clear the horizon may be, has no other way of knowing where he is than the dead reckoning, and no other guide for steering than the compass.
>
> 'We often hear stories of marvellous exactness with which the dead reckoning has been verified by the result. A man has steamed or sailed across the Atlantic without having got a glimpse of sun or stars the whole way, and has made land within five miles of the place aimed at. This may be done once, and may be done again, but must not be trusted to on any one occasion as probably to be done again this time.
>
> *'Undue trust in the dead reckoning has produced more disastrous shipwrecks of seaworthy ships, I believe, than all other causes put together.'* " (Italics ours.)

Another observation by *Lord Kelvin* may be helpful:

> "Still, the man remembers a time or two when he has hit the mark marvellously well by absolutely dead reckoning; he actually forgets his own prudence on many of the occasions when he has corrected his dead reckoning by the lead, and imagines that he has been served by the dead reckoning with a degree of accuracy, with which it is impossible, in the nature of things, it can serve any man. Meantime, he has earned the character of being a most skilful navigator, and has been unremitting in every part of his duty, according to the very best of his intelligence and knowledge. He has, moreover, found favor with his owners, through making excellent passages in all weathers. *At last the fatal time comes, he has trusted to his dead reckoning once too often, he has made a 'center,' not a 'bullseye,' and his ship is on the rocks.*" (Italics ours.)

Great emphasis is placed on ***the use of the lead*** or ***deep sea sounder*** when its use is practicable, and ***the allowance for the interferences*** stated on page 88.

THE LEAD.

(The lead is here used to include soundings by the ordinary lead—blue pigeon—or by the deep sea sounder.)

An improper position may have bearing in ascertaining the cause of collision. Next to accurate land bearings and accurate celestial observations, the lead is regarded as ***the most exact aid to navigation*** in determining position, and is used in connection with the depths shown on government charts. Indeed, when near land, or as a test of other methods, it is undoubtedly ***the most important aid to navigation.***

Lord Kelvin admirably states the case:

> "What then, on approaching land in cloudy weather, does the navigator do who is not only careful but prudent, not only bold and able but also intelligent and well taught, not only devoted to the interests of his employers but devoted with a knowledge which they can scarcely be expected to appreciate? ***He simply feels his way by the lead,*** from the time he comes within soundings, 'till he makes the land and makes sure by lighthouse and landmark of where he really is. Neither annoyance to the ship's company through the extra labor which it entails, nor consideration of the detention which it may require, prevents him from using the deep sea lead at least once an hour, unless he has satisfactory grounds for confidence in proceeding with less frequent soundings."

Gill (a prominent English authority) sounds this warning:

> "Near land in foggy weather, the greatest security for the navigator is the frequent use of the 'lead' and feeling his way by 'ground navigation.' A line of soundings and specimens of the bottom (brought up by the 'arming' of the lead) will generally enable him to fix his position on the chart, or give him due warning of danger. In Board of Trade inquiries into cases of stranding, ***the first importance is properly attached to the taking of soundings,*** and woe to the captain who may be found to have neglected this precaution."

The lead should be used freely to test the vessel's position, and ***its use should not be delayed until doubt has arisen.***

Secure a safe cast, regardless of the number of times the ship is slowed for accuracy. ***A single cast of the lead is of no value.***

In doubt, cast as often as necessary to remove doubt. The point is to be sure.

Even when not in doubt casting the lead is beneficial to promote *accuracy* in its use.

The lead should be cast under the supervision of an officer, and the *best leadsman* should be employed.

One man should cast the lead at bow while an officer and one man take up slack at stern. As the lead reaches bottom, quickly raise and touch again *to be sure of bottom*, noting mark on line at rail. Deduct distance from rail to water from total length of line, *both men agreeing. Allow for the "stray" of line* and any shrinking or stretching of the line. In strong wind or under much speed the "stray" is usually so great as to show a greater depth than that which actually exists.

Great care should be exercised in selecting a line least subject to stretching or shrinking. It should be tested by measure when *wet*, and this is desirable for each period it is used.

Eighteen fathoms is about the limit depth detectable with a lead line at a 14-knot speed, but this is not a safe method. Slowing down is essential for accuracy. Five fathoms at about 10 knots or 10 fathoms at about 6 knots is the average safety cast.

For depth greater than 18 fathoms, or at high speeds, the deep sea sounder should be used.

The lead should always be "armed" with soap or tallow to pick up bottom, and the bottom should be reported in addition to the depth, and the specimen sent to the navigator. The bottom affords an excellent test of position as evidenced by the chart, and *proves that bottom was reached.* During these soundings the chart should be read with great care, and the course traced out by the *depth* and *character* of bottom.

The great importance of this has been practically demonstrated to the writer, who has observed runs, made in the most dangerous part of the American Coast, through a thick "vapor" more dangerous than fog, caused by a prevailing, strong, cold "Northwester" acting on the air and waters warmed by the Gulf Stream. With no other method at hand, the following test was a comparatively accurate aid: Soundings were made and bottom was brought up every half hour, and the method explained by *Sir James Anderson* and *Lord Kelvin,* and highly recommended by *Lecky* (except that he suggests tracing paper instead of cardboard) was adopted:

> "Take a slip of card, or stiff paper, and mark along one edge of it points at successive distances from one another, equal, according to the scale of your chart, to the actual distance estimated as having been run by the ship in the intervals between successive soundings. If the ship has run a straight course, the edge of the card must be straight, but if there has been any change of direction in the course, the card must be cut with a corresponding deviation from one straight direction. Beside each of the points thus marked on the edge, write on the card the depth and character of bottom found by the lead. Then place the card on the chart, and slip it about till you find an agreement between the soundings (and bottom) marked on the chart and the series marked on your card."

Good lights, a vigilant lookout, with speed under control, and constant casting of the lead, with good judgment applied in reading the chart, cover the essential safety methods in dangerous places.

A ***drift lead*** may be of assistance in estimating drift, or when at anchor in localities where the rise and fall of tide may cause damage or grounding, or where notice of dragging is desired.

A dry lead line is a silent witness to a navigator's indifference to duty and a standing menace to his reputation, to his future, and indeed, to the lives and property under his care.

(See ***False Departure,*** page 89.)

THE DISTANCE LOG.

(The term "Knot" indicates a nautical mile.)

The log measures the distance travelled.

In the nature of things logs cannot always be accurate. This devolves upon the navigator (when the log becomes an element in the calculation, especially in dead reckoning) great care in making due allowance for any of its known defects and for outside interfering conditions. For example, the log, when accurate, measures only the distance through the water (not over the bottom), and full allowance must be made for ***leeway, current,*** and ***swell,*** and the chance for ***difference in the records*** of different watch officers that judge the speed, to ascertain the distance over the bottom. As the rule of divergence may be used to check position, so outside observations may be helpful to approximate speed, as a check against the log. Experienced navigators become very proficient in judging speed by the feel of the vibrations, and by watching objects dropped overboard. A ***ground log*** may be used to judge speed over the bottom, and to indicate leeway or drift. A ***chip log*** may be used to advantage to test a doubtful patent log.

A rule which is correct within a few feet is that a vessel is running in knots per hour the number of hundred feet she is running per minute—for example: A ship running ten hundred (1,000) feet in one minute is running at the rate of 10 knots per hour, and vice versa.

The method of ascertaining speed by multiplying the pitch of the propeller by the revolutions and deducting slip may not be depended upon, because the effect of wind, leeway, current, and swell, which affect the percentage of slip are rarely ***safely*** approximated, except after the true log distance is known. Slip has been known to vary between 10% and 50%. This rule is: Multiply the pitch by the revolutions per minute, deduct the slip, and the remainder represents feet per minute; multiply the feet per minute by 60 to secure feet per hour, and divide by 6080 to secure knots per hour; or multiply the revolutions per hour by the pitch, deduct slip, and the remainder represents feet per hour, then divide by 6080 to secure knots per hour.

It is as essential to test the log as to test the compass and chronometers or clocks, and an error card should also be kept for the log, noting its long or short error, at stated points, where known distances can be determined.

Regular periodic tests on runs of known distance should be thus carefully recorded. The log error is also often variable according to the degree of speed, and the error card should also give this information.

In a fog or bad weather *overlogging* is always a serious danger and is always to be apprehended, but this may be corrected by the lead, when practicable.

After all available methods are applied to secure a safe departure, and the tests are applied to check the position, *remember always that the armed lead or deep sea soundings, compared with the chart for depth and character of bottom, will round out the tests* with more accuracy than any other method.

THE COMPASS.

The compass records the direction pursued.

Unknown *error* in the compass may be the cause of condemning a skilful navigator for a collision, when it is the cause of an improper course.

A competent navigator quickly discovers errors in his compass on his known courses. Careful navigators will take azimuths and amplitudes at frequent intervals. Compass errors are usually so general that on established courses nearly every vessel makes some allowance for error; but this allowance is too often a matter of memory or custom, and it is not reduced to a permanent record (error card). The cautious navigator will have these errors fully understood on his vessel, and *will*

insist on his compasses being kept in good order, and will see that the proper deviation (error) cards are posted in suitable locations.

The standard or "master" compass should be placed in as nearly a neutral part of the vessel as can be found, (in one instance this point was located in the smokestack, so the compass was placed elsewhere), and frequently compared with the pilot house compass. ***The Captain's room should also be provided with a tell-tale compass agreeing in all respects with the pilot house and standard compass.***

The compass course at sea should be inspected by the commanding officer every fifteen minutes at least, and oftener in inland navigation. This should be done in addition to the reading of the compass by the quartermaster at every half hour bell, referred to under ***repetition of orders and reports,*** page 129.

The only safe method for reading the compass is to stand directly behind it. Readings from the side or at an angle give rise to appreciable error.

In using a movable compass the lubber line should exactly parallel the keel of the vessel. Where compasses are marked only with a lubber point, great care must be exercised in placing the point so it points directly forward.

COMPASS ERROR.

The compass may be in error in at least eight respects. Such error, when due to the compass, or to local vessel conditions, is termed ***deviation;*** when due to the earth's influence it is termed ***variation.***

DEVIATION.

First: It may be out of order—a mechanical fault inherent in the compass itself.

Second: It may not be properly adjusted to the shifting sub-permanent magnetic qualities of the vessel, the location of metallic lifeboats, and the electric or wireless plants or wires leading from them.

As the disturbing influence of iron construction becomes better known more attention will be paid, in shipbuilding, to the horizontal and upright iron in the vicinity of pilot houses, ***and the ship's head will be changed during construction,*** thus partially counterbalancing the disturbance referred to under the second and fourth points. This should be a requirement in all specifications. Some of this, (the second and fourth error), may "shake out" with time.

Third: It may have temporary errors due to the magnetic qualities and location of cargo, which shift according to the change of the ship's head, notwithstanding the cargo remains stationary.

Fourth: It may have temporary and variable error, due to the magnetic qualities of vessel and cargo when the ship *heels, rolls, or lists.* This also shifts according to the change of the ship's head. This error is small in wooden ships, but the compasses of iron ships are much affected by it. Northerly and Southerly courses are more affected than Easterly or Westerly courses. The error reaches its maximum on North and South headings, north of the equator, and reverses its effect on crossing the equator. It is a very subtle and elusive error, and, with all the known devices to automatically correct it, it has so far remained a most variable and uncertain element.

Since the errors on even keel should be corrected, and applied only to the vessel while in that position, the heeling error for different degrees of heeling should be tested, and taken into account when the compass is not equipped with compensating heeling magnets.

So too must the semi-circular error be considered in compasses not properly corrected for this error. In the modern compass, compensation is also made for this by means of compensating magnets.

Fifth: It may have temporary or shifting errors (when persons carrying metal about them stand near the compass); or such errors may be due to magnetic qualities of vessel and cargo when affected by magnetic storms (usually occurring when the vessel is struck by lightning; this is ordinarily brief but causes great compass disturbance).

Sixth: Very *high* speed may develop electrical conditions which materially affect the compass. In the "Lion" of the British Navy the heat developed by forcing her caused great compass error, but this error is exceptional.

The first cause may be discovered and remedied and the second may be fairly well compensated, by the compass adjuster. The fourth may also be substantially remedied by the compass adjuster when the vessel is equipped with compensating magnets for heeling and semi-circular error.

The third and fifth causes are variable and are only determinable on shipboard by swinging the ship for compass error on reciprocal bearings, on established courses or ranges, or by observing the azimuth and amplitudes. So may all errors be kept track of by frequent observations of this character.

The sixth cause is regulated by the speed.

Seventh: A "crazy" or "spinning" compass is only temporarily in error, and is usually due to heavy seaway causing the ship's fluctuating magnetism to shift rapidly; or it may be due to temporary electrical atmosphere.

The vessel and cargo sub-permanent (shifting) magnetism may be likened to water contained in a bucket, which is passive when at rest, but when the bucket is rotated or tilted, the water takes on new forms of disturbance.

A correctly posted error (deviation) card located where all can see it is most essential, and full allowance should be made for such errors (deviations).

VARIATION.

Eighth: (a) It may have temporary errors due to local magnetic influences of the earth's metal deposits, or (b) due to the local influence of the earth's magnetic current.

The first of these influences (a) is very rare, the second (b) is frequent and variable, and is shown as *variation* in the compass imprints on official charts. The difference between the location of the Magnetic Pole and the true North Pole largely accounts for variation.

Strictly speaking both deviation and variation are *error,* but the term error is generally applied to *deviation.*

Since it is noted that compass error is so general and, with the most careful correction, must always remain doubtful, the main reliance—the lead, or deep sea sounder—should be frequently used.

For extended information on compass error, see "*Popular Lectures and Addresses, Vol. III., Navigation,*" by Sir William Thompson; "*Navigation and Theory of Compass Deviation,*" by Muir; "*The American Practical Navigator,*" by Bowditch; "*Text Book on Navigation,*" by Gill; and a paper on "*Deviation, Its Avoidance and Correction,*" by Lieutenant-Commander L. H. Chandler (1908).

THE COMPASS ROSE.

(A bearing plate may also contain divisions similar to the compass rose, but it is generally designated in points to starboard or port, either for bow bearings or quarter bearings.)

The compass rose contains 32 points, and should be as familiar to the skilful navigator as his a, b, c's. The writer has encountered many reputable navigators wholly deficient in this respect. Those entering the profession should learn how to properly "box" the compass and "reverse a course."

Boxing the compass.—For practice, the reading should start with North and work around to South, and vice versa, both Easterly and Westerly.

Example:

N. to S. Easterly:

N., N.xE., N.N.E., N.E.xN., N.E., so far North is the most prominent point; then it takes up E. as the prominent point: N.E.xE., E.N.E., E.xN., E., E.xS., E.S.E., S.E.xE., S.E.; then it takes up S. as the prominent point: S.E.xS., S.S.E., S.xE., S.

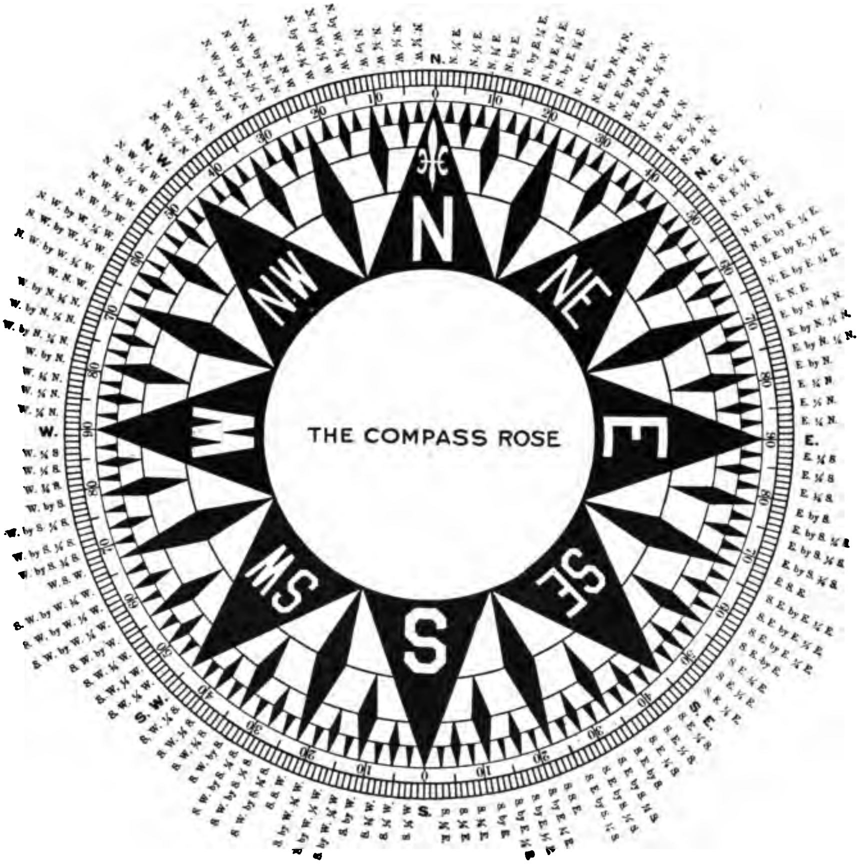
N. to S. Westerly:

N. N.xW., N.N.W., N.W.xN., N.W., so far North is the most prominent point; then it takes up W. as the prominent point: N.W.xW., W.N.W., W.xN., W., W.xS., W.S.W., S.W.xW., S.W.; then it takes up S. as the prominent point; S.W.xS., S.S.W., S.xW., S.

Thence S. to N. Westerly and S. to N. Easterly.

Fractional points are usually read in eighths, quarters, and halves, and are added to the above points, viz.: N.⅛E., or N.W.¾W., etc.

Sometimes compasses are improperly read by calling backward, for example: N.E.xE. is sometimes called E.N.E.xN. (and so of similar points); while this may be correct in one sense, it is unseamanlike, and is apt to be confusing. It is needless to add that the veriest novice would not designate N.N.E. as N. 2 points E. An aid to memory lies in the fact that the point on either side of the cardinal points, N. E. S. and W., is named after the cardinal point used in that direction, viz: S. one point West is S.xW.; E. one point North is E.xN.; this is also true when reading from the points N.E., S.E., N.W. and S. W., viz: N.E. one point E. is N.E.xE. The other midway points between N. and N.E., E. and N.E., S. and S.E., E. and S.E., N. and N.W., W. and N.W., S. and S.W., and W. and S.W. are designated by double cardinals


THE COMPASS ROSE
N
NE
E
SE
S
SW
W
NW
N.
N. E.
E.
S. E.
S.
S. W.
W.
N. W.

taken nearest the point to be read, viz: the point midway between N. and N.W. is N.N.W., that is two Norths and a West, and the point midway between W. and N.W. is W.N.W., that is, two Wests and a North.

The compass imprints on government charts are provided with degrees, and this method of reading is coming largely into favor because of its exactness. A circle contains 360 degrees, a half circle 180 degrees, which is the distance in degrees from North to South; it therefore follows that from North to East is a quarter circle, and contains 90 degrees. Therefore 90 degrees is equal to 8 points or from straight ahead to abeam. The half of 90 degrees is 45 degrees, and this is equivalent to 4 points. By dividing the 360 degrees of the circle by the 32 points of the compass we secure the co-efficient "11¼°" for each point, so this multiplied by any number of points will equal the degrees, viz.: 4 points x 11¼ degrees equals 45 degrees.

Reversing a course.—This is very simple: S.S.E. reversed is N.N.W., N.xW. is S.xE., N.W.xN. is S.E.xS. and so on. It is observed that the exact reverse of each sign is given, viz., S.S.(N.N.)E.(W.), or N.(S.)xW.(E.), or N.W. (S.E.)xN.(S).

THE GREAT IMPORTANCE OF ALLOWING FOR COMPASS ERROR.

A vessel found off her customary course through any neglect may be charged with fault in event of collision.

When taking "cross" bearings or single "point" bearings and then charting position for a departure, or when determining distance and course run to "fix" position for a departure, and also when setting or testing a course, due allowance for the *deviation* of the compass (in addition to the other interferences named on page 88 must *always* be made. Most of the interferences mentioned are usually discounted, but *deviation* of the ship's head, at the time of taking the departure due to compass *error* and *heeling* deviation, is frequently overlooked, and, even when allowed, there is great danger in applying it the wrong way, thus *doubling* the error. *This is often fatal.* This point has been emphasized by navigators, as of first importance. The following is a thoughtful observation by an experienced master mariner on this point:

> "For example: Ship's course Southeast by South, deviation 1 point Westerly. 9.30 P. M., sighted Cape Cod Light bearing Southeast by South right ahead. Distance off, ten miles. Fog shut in, obscures light. Navigator lays off his Southeast by South course on his chart and finds that this course and bearing of Cape Cod Light will carry him to Peaked Hill Bars whistling buoy. Now in this case, with one point of Westerly deviation, the ship is actually making a Southeast correct magnetic course, instead of a Southeast by South course. The ship is two miles South and Westerly or nearer the beach than the navigator supposes. Now draw a line from Cape Cod Light bearing Southeast and place your ship ten miles off and run her on a Southeast course, correct magnetic, and you will find your ship on Peaked Hill Bars.
>
> "The lead here will not be an entirely safe guide, as a ship on this course will have 22 fathoms of water within one mile of Peaked Hill Bars, and if our friend assumed he was two miles further off shore, 22 fathoms would be safe to pass the shoal and he would feel safe until he hit the sand bar.
>
> "I have been shipmate with many apparently bright men who never thought of deviation when taking a cross or point bearing, or when laying off a ship's position on a chart.
>
> "Another example: Ship's head South half West. Deviation ½ point Westerly. I took a 4 point bearing on Cape Hatteras Light, and when light was abeam I found the ship to be ten miles off. The ½ point deviation does not affect the distance found off the light by the 4 point bearing, but if one does not allow the ½ point deviation for the ship's head when the light is abeam he will lay off his position one mile too far South. In other words, he will lay off his position at the light West ½ North, when the correct magnetic bearing would be West.

> "My reason for calling your attention to this matter is that I have found so many officers utterly neglectful in allowing for deviation when taking a cross-bearing or point-bearing to fix position, or when laying out a course on the chart."

Note.—The above examples are given to illustrate, by extreme deviation, the danger in incorrectly locating position, and not as practical and usual methods in navigating in the localities named.

Remember the lead.

VARIABLE CURRENTS.

Currents are known as constant, variable, and periodic. The thermometer and hydrometer are employed in testing temperature and density at the surface for the purpose of discovering current.

Currents shown on the charts and guides are not uniformly constant in strength or direction, and new currents are constantly exerting their influence towards diverting the vessel from her course, though she may be steered correctly. "Eager" tides may also be variable.

The following is from an experienced navigator:

> "The more skilful the navigator, the more sure he is of the position given him by the scientific methods he uses. *It is this certainty of position of the skilful navigator that lulls him into a fancied security,* and causes him to neglect casting his lead soon enough to discover that an unknown current has destroyed his reckoning. The amateur navigator rarely makes this error, because his frequent use of the lead warns him in time."

A drift lead or ground log, or the effect on buoys, or observation of the angle made by the wake may aid in determining the direction and strength of drift. Some vessels are rigged with a bearing plate on the taffrail, and the log line is held over it to determine the angle of drift; this, however, is only an aid, and may not, in itself, be entirely conclusive.

Remember the lead.

LEEWAY AND SWELL.

Leeway and swell exert a powerful interference against true compass courses, and must always be safely discounted. The use of a drift lead or ground log, or the observation of the vessel's patent log line, or wake, in relation to the keel line, or the effect on buoys, will aid in estimating the angle of drift.

A vessel may sometimes edge or creep *toward* windward or *against* a current when she rolls.

Remember the lead.

ERROR IN STEERING.

In a sailing vessel the tendency (under wind pressure) is to "luff" or "yaw." In a steamer her head (under the influence of her propeller) tends to starboard or to port. Wind, tide, current, and swell are also constantly exerting their influence on all vessels. In each instance a compass course "made good" requires constant manipulation of the helm or wheel.

The only safeguard here is to have intelligent helmsmen, or quartermasters, frequent repetition of the compass course by them, and *periodic observation of the course by the navigating officer.* (See *Repetition of Orders and Reports,* page 129.)

Remember the lead.

ASCERTAINING POSITION AND DISTANCE BY BEARINGS, HEIGHT, SOUND, ETC.

Determining position and distance by "cross" bearings from two or more objects.—When permanent objects are observable, "cross" bearings taken in *quick succession* from two or more fixed objects is one of the most reliable means of finding distance, or "fixing" position ***at the point where the bearings intersect on the chart.***

Great care must be used to correct each bearing for deviation (error) and, where the compass "rose" or bearing plate used is not magnetic, correction of each bearing must also be made for variation.

Finding position and distance by "point" bearings from a single object.—

(See Diagram, Page 108.)

(A) Distance may be ascertained before arriving abeam of the object.

(B) At the time of arriving abeam.

(C and D) After passing.

(a) TWO-POINT BEARING FORWARD OF BEAM.

Take a 2-point bearing (A to L), steer steady; when the object bears 4 points (B to L) note the distance travelled (A to B); .71 (.7 is sufficient for all practical purposes) of that distance is the distance to the object when it is abeam (D to L).

Explanation:

A to B = 5 knots.

5 × .7 = 3.5 (3½) knots distance D to L.

This result can be checked by the next bearing.

(b) FOUR-POINT BEARING FORWARD OF BEAM.

(For all practical purposes, of all the "point" bearings, this bearing is the simplest, the most used, and the most reliable.)

Take a 4-point bearing (B to L), steer steady and note distance travelled (B to D), when the object is abeam; the distance travelled from B to D is the distance to the object abeam (D to L).

Explanation:

Distance travelled B to D = 3½ knots. The two sides of the triangle are the same. The distance from D to L is also 3½ knots, thus checking up the 2-point bearing.

(c) TWENTY-SIX AND ONE-HALF DEGREES BEARING FORWARD AND ABAFT BEAM.

Take 26½° bearing forward of beam (C to L), steer steady until the object bears 26½° abaft beam (E to L); the distance travelled (C to E) is the distance the object was passed when abeam (D to L).

Explanation:

Here we have a triangle with its base equal to its perpendicular. The distance travelled from C to E is 3½ knots, which is the distance the object was passed D to L, again checking the 2-point and the 4-point bearing.

(d) FOUR-POINT BEARING ABAFT BEAM.

Take a bearing abeam (D to L), steer steady and note the distance travelled when object is 4 points abaft beam (F to L). This is the distance object was passed (D to L).

Explanation:

This is the reverse of the 4-point bow bearing and again checks the distance. The two sides of the triangle are the same. The distance travelled D to F is 3½ knots, which is the distance D to L. This checks the 2-point, 4-point, and 26½° bearings.

All vessels should be equipped with a compass or bearing plate for forward and abaft beam observations, conveniently located to insure correct bearings being found.

The accuracy of these distances depends upon the ability to steer an accurate course without deflection.

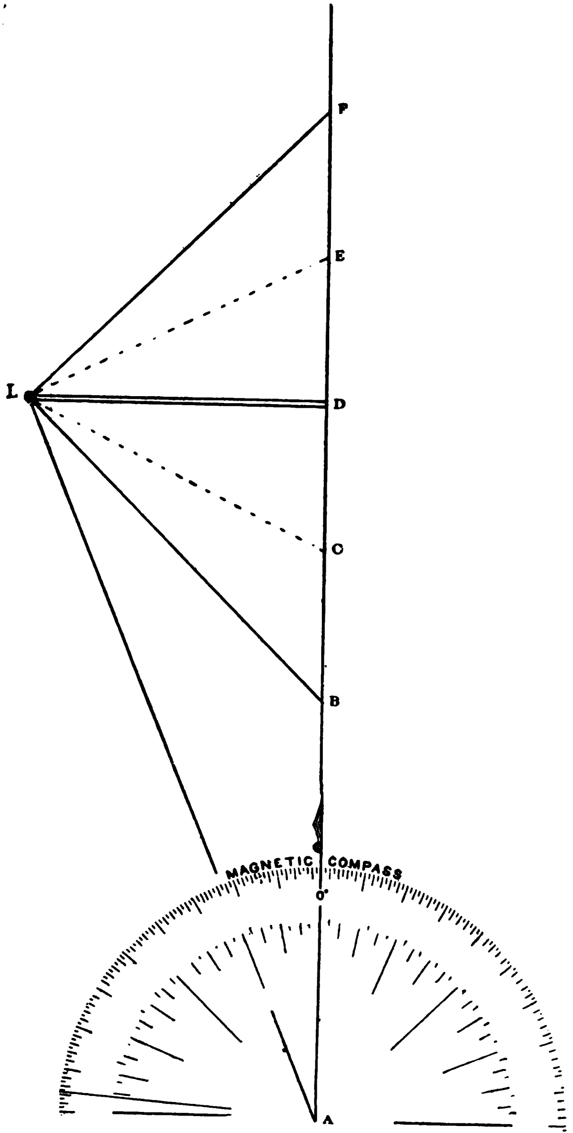


DIAGRAM ILLUSTRATING APPROXIMATE PASSING DISTANCE DETERMINED BY BEARINGS.

Captain Patterson refers to a method of taking two bearings from a single object, noting the distance and course run between the points after the bearings are taken, and then drawing the bearing lines and locating the points of observation on the chart by laying down the course between the two bearing lines where the distance covered exactly equals the space between the two bearing lines, the ends of the course line so laid down being the two positions from which the bearings were taken; allowance must be made for a possible change of position during the calculations. This appears to be somewhat similar to the application of one of the elements in "Sumner's Method" (in Sailing).

Determining distance by height.—The distance of the visible horizon in a normal atmosphere is approximately as the square root of the height the eye is above sea level. This is only approximate; for accuracy the usual distance tables should be consulted.

(The square root of a number is that factor when multiplied by itself produces the number.)

Examples:

Eye height 36 feet. Square root and distance = 6 knots.
Eye height 9 feet. Square root and distance = 3 knots.

Standard marine works adopt, as approximately correct, the following formula applying to two known heights.

A light of standard intensity or an object, when it first shows at the horizon, is distant the sums of the square roots of the elevations of the light or object and the eye of the observer.

Examples:

Observer's eye... 16 feet above sea level. Square root 4
Light .... 50 feet above sea level. Square root 7+

Approximate distance.............................. 11 knots.

Observer's eye... 36 feet above sea level. Square root 6
Light ....100 feet above sea level. Square root 10

Approximate distance.............................. 16 knots.

The above is modified by rise and fall of the vessel when the observations are made.

Refraction requires the distance to be increased about 10 per cent.

Finding distance by sound.—*Light* moves at a velocity of 186,000 miles per second. *Sound* moves at a velocity of about 1,090 feet per second at 32° F. and increases or decreases about one foot for each degree, as the temperature is above or below this point, qualified at all times by existing atmospheric conditions.

By observing the time between sighting the escaping steam from a whistle or the flash of a sound signal, and the time the sound reaches the observer, the distance can be reasonably approximated by allowing a scant mile for every five seconds of interval between observations.

Example:

> Sound from a steam whistle reaches an observer five seconds after exhaust is seen. Temperature 60° (add 28 feet as difference between 32° and 60°).

$$1090 + 28 = 1118 \text{ feet per second.}$$
$$1118 \text{ feet} \times 5 = 5590 \text{ feet distance.}$$

Atmospheric conditions may somewhat modify the calculation. In water, the velocity of sound is more than four times greater than the above velocity.

Vibrations must not be under 24 per second, nor over 30,000 or 40,000 per second to be heard by the unaided human ear.

The penetration of sound depends upon its vibration, distance, and the conducting medium.

Both sound and light waves may be reflected from an opposing surface (reflection in the case of light, and echo or resonance of sound). Both may be refracted (or diffracted) in passing obstructions or from one medium to another, or may yield to interference which, when intermittent, gives rise to pulsations, (light flashes—sound beats); this condition requires the exercise of much caution in the effort to locate aids to navigation. (See *Atmospheric Phenomenon*, page 66.)

Fog, mist, vapor, rain, hail, and snow do not necessarily affect sound. Its aberrations are often pronounced in the clearest weather.

Other methods for finding distance.—Distance is also ascertained by two bearings of the same object, (other than the "point" bearings above stated), but this involves a problem in plane trigonometry. The calculation being complicated, it is omitted in view of the simpler methods above referred to.

In "fixing" position by any of the above methods, never omit check with the lead or sounder.

DIVERGENCE.

(See Diagram, Page 112.)

Under this subject the usual methods are referred to, with particular reference to the means of using the point with the least possible risk. It is of principal value in ***testing*** position, but it ***may not safely be used as the only method*** in running for position or in establishing a departure.

It is emphasized, therefore, that the ***rule of divergence*** should be used more as a test than as a primary method in fixing departures, or in locating position.

The following is an approximately correct formula for divergence:

A divergence of one-quarter point will throw a vessel off a course one-twentieth of the distance she has travelled, ***but in applying this rule or the following tables, due allowance must be made for the interferences mentioned below.***

By using the following basis, with correct allowance when required for these interferences, viz., ***leeway, tide, current, swell, set of screw (if a steamer), error in steering, compass error, deviation due to heeling*** or ***list, semi-circular error*** of compass, and ***log error,*** any divergence may be quickly figured:

Compass Point Divergence.	Distance Travelled.	Located from the Projection of the Other Course.
¼ point (2.8125°)	5 knots	¼ knot.

By a simple method of multiplication any divergence may be calculated. For example: A vessel has run from a departure on a 2-point divergence (1 by compass, ½ deviation and ½ drift, no error in steering) say for 200 knots, and it is desired to ***confirm a position otherwise ascertained.*** Raise ¼ point to 2 points by multiplying by 8, (there being eight quarters in two points), and multiply location by same factor.

Example:

Point.	Distance.	Location.
¼ point	5 knots	¼ knot.
x8		x8
—	—	—
2 points	5 knots	2 knots.

Then raise 5 knots to 200 knots by multiplying by 40, and multiply location by same factor.

Example:

Point.	Distance.	Location.
2 points	5 knots	2 knots.
	x40	x40
—	—	—
2 points	200 knots	80 knots.

By testing back, under the rule, we find there are eight quarter points in two points, so that the divergence will be 8/20 of 200 or 80 knots.

For quick reference the following table, and the diagram shown on opposite page, will illustrate ¼, ½, 1 and 2-point approximate divergences in 5, 10, 15, and 20-knot runs. This

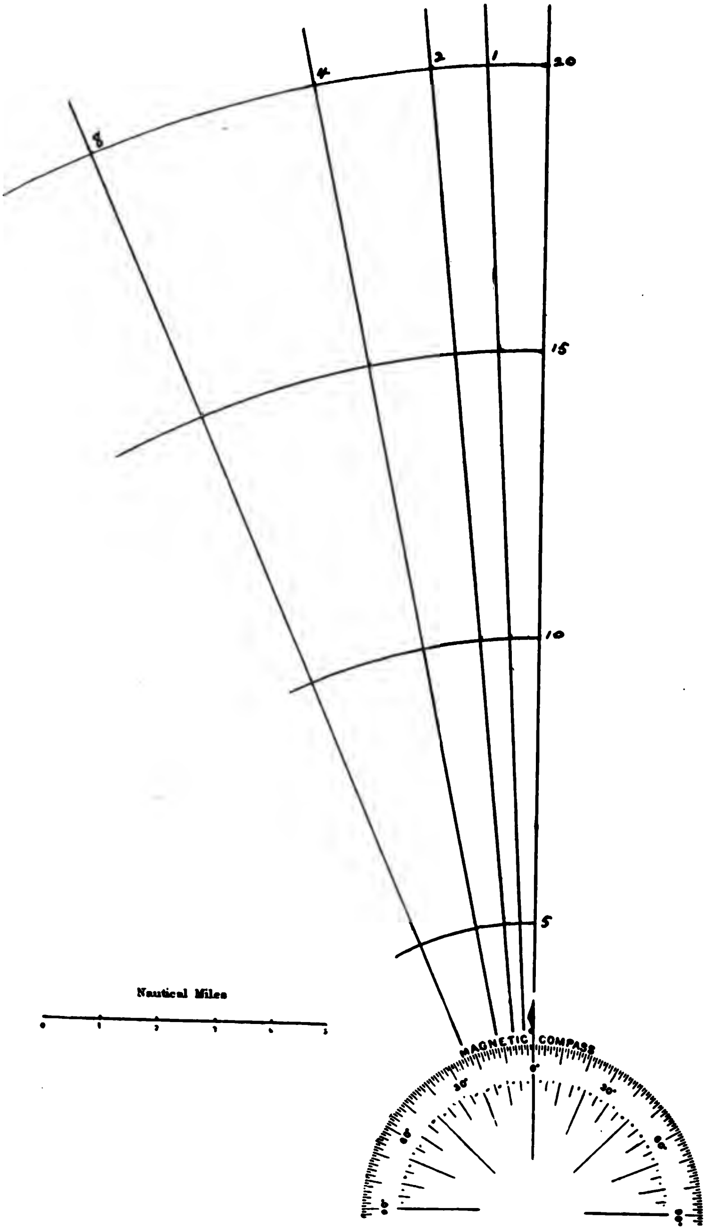


DIAGRAM ILLUSTRATING THE RULE OF APPROXIMATE DIVERGENCE.

does not include the interferences shown on page 88, for which allowance must be made, when they affect the calculation.

Compass Point Divergence.	Distance Travelled.	Located from Original Course.
¼ point	5 knots	¼ knots.
	10 "	½ "
	15 "	¾ "
	20 "	1 "
½ point	5 knots	½ knots.
	10 "	1 "
	15 "	1½ "
	20 "	2 "
1 point	5 knots	1 knots.
	10 "	2 "
	15 "	3 "
	20 "	4 "
2 points	5 knots	2 knots.
	10 "	4 "
	15 "	6 "
	20 "	8 "

VARIABLE DRAFTS (SETTLING) DUE TO WATER DENSITY.

Salt water drafts.—Approximately, a vessel will rise 1/40 of her mean fresh water draft on entering salt water.

For example:

Mean Fresh water draft is 16′ 8″ = 200″
1/40 of 200 = —5″
Mean Salt water draft = 195″ or 16′ 3″

Fresh water drafts.—Approximately 1/40 of the mean salt water draft added to that draft will give the mean fresh water draft, showing how much the vessel will settle.

Example:

$$\begin{array}{lr} \text{Mean Salt water draft } 20' = & 240'' \\ \tfrac{1}{40} \text{ of } 240 = & +6'' \\ \hline \text{Mean Fresh water draft} = & \begin{cases} 246'' \\ \text{or} \\ 20'\ 6'' \end{cases} \end{array}$$

Both of the above calculations may be affected by the specific gravity of the particular water (which varies considerably) and by the ship's speed and model, and (slightly) whether the ship's bottom is foul or clean.

SQUATTING BY THE STERN CAUSED BY SPEED.

Speed has an appreciable effect on displacement and the altered resistance of the water and bottom, and the change in displacement again affects the speed. This often enters as a factor in collisions when estimating speed between fixed points, or when determining the tendency to run off under suction or sheer.

A narrow beam vessel, dragging a foul bottom at high speed, will squat more perceptibly than broad beamed clean vessels.

While not constant in all types of vessels, the following record of squatting may aid as a rough guide:

At 18 knots, settles 4 feet at stern.
At 14 knots, settles 2 feet at stern.
At 8 knots, settles 1 foot at stern.
At 6 knots, scarcely perceptible.

When extremely slow, no squatting is observable. Tide and current also have a slight effect.

Squatting may also be affected by the specific gravity of the particular water (which varies considerably), and the ship's speed and model, and whether the ship's bottom is foul or clean.

"Settling" and "squatting" are always danger points in shallow waters, because of suction, and the tendency to sheer, and when passing vessels.

It is, therefore, safer to periodically observe the increased draft caused by the change of "settling" and "squatting" under the respective speeds.

The deep draft at the stern, caused by squatting, may be overcome by slowing down, thus minimizing the tendency to sheer.

SUCTION.

Vessels approaching from opposite directions are not appreciably influenced by suction, but, when they pass very close, side or quarter "swipes" may occur.

When passing in the same direction close aboard, suction exerts a powerful effect to deflect the smaller vessel toward the larger one, and ***it may develop into a sudden, rank and violent sheer.*** The inrushing water filling up the wake of a large vessel and the "in" propeller currents, will ordinarily attract a smaller vessel, but a small vessel may attract a large vessel, if the speed of the smaller vessel is greater and overcomes the differences in the size, power, and draft of the larger vessel.

In "Experiments," by ***Hewins*** and ***Thorne,*** with models, it appears that vessels may attract each other substantially as follows: After the overtaking vessel's stem draws by the stern of the overtaken vessel, the bow of the overtaking vessel first swings toward the quarter of the other vessel; as they draw abreast each vessel moves laterally (sidewise) toward the other, and, as the stem of the overtaking vessel draws ahead of the stem of the overtaken vessel, the overtaking vessel's bow goes off and her stern first swings toward the overtaken vessel's side and then, (as she advances), towards the overtaken vessel's bow. It has also been noticed that the overtaken vessel's stem falls in toward the overtaking vessel's quarter. *(See Report in Volume 17 (1909) of Society of Naval Architects and Marine Engineers.)*

The factors appear to be the size and speed of the vessels, the depth of the water, and the mass and extent of the water falling in upon and drawn away from the quarters and sides of the vessels, and the effect of wind, swell, and current. In abundance of water, the effect is probably slight. In shoaling water, it exerts its maximum influence, and is operative for a considerable distance.

At the Hoboken fire the steamship *Bremen* was drawn out of her slip by the suction from the steamship *Kaiser Wilhelm.*

The preventives against squatting, suction, and sheer, when effective, lie in allowing ample passing room, the proper and prompt use of the helm, and PROPER REGULATION OF SPEED.

SHEER.

It may be confidently stated that no two vessels act exactly alike in their navigation, and this relates to suction and sheer, but there is some constancy in general results. Some navigators of experience believe that the sheering of vessels is influenced by unaccountable or mysterious cause, but this is, perhaps, largely due to the lack of data relating to the action of certain models in certain depths, under varying speed, and their individual behavior in proximity to vessels, and to banks, bottoms, and shoals of channels.

A large percentage of alleged sheers is generally due to mistaken position in the channel; or a too close approach to other vessels where *suction* exerts its influence; or a too early or too abrupt use of the helm, or a violent change brought about by reversing from full speed ahead to full astern, any one of which sets up a "kick" away from her helm. This is intensified when several of these causes operate together. (See *"Kick,"* page 121.)

Two prominent conditions occur in channel sheers with some constancy, and offer some ground for a reasonable solution of their cause, irrespective of the vessel's speed, model, or construction, namely:

(1) ***The initiative sheer starts gradually and stealthily until,***

(2) ***It reaches a point where the sheer becomes sudden and rank, and, too often, uncontrollable.***

The following theory is advanced for consideration:

The initiative sheer is doubtless due to the approach of the vessel toward shoaler water, with the attendant compression of the water on the shoaling side, causing compression first ***at the bow*** and a "send," throwing the rudder toward the channel side, both influences then exert a tendency to throw the head toward the channel side. As the vessel then parallels the bank, a ***larger*** body of quick water falls in upon and follows up the vessel's quarter ***on the channel side*** than on the shoaling side. The unequal pressure then ***at the quarter,*** on the channel side, in combination with the kick of the rudder towards the channel side, caused by the deflection of the ship's head, set up cumulative forces thought to be the ***causes of the sudden rank sheer towards the channel side,*** so difficult to control when passing vessels.

The "kick" from the propeller when reversed and the "kick" from the helm when put hard over, are relative influences, but these are not pure sheers when they occur alone, for a pure sheer, here mentioned, may sometimes be avoided by control of speed, but so-called sheers from improper use of the helm and reversing may not always be affected by speed. (See *"Kick,"* page 121.)

Sometimes a vessel may reverse the above tendency and at first run toward, instead of away from, shoaling water, but this is the exception to the rule, and doubtless finds its explanation in the effect of wind or current or both. Indeed, wind and current may control the movements. In these instances the resulting sheer is augmented by the additional impetus of the "send", developed by actual contact with bank or bottom.

The topographical condition of the channel often causes a vessel to *"smell bottom,"* and voluntarily seek deeper water.

A great many vessels act queerly in shoaling water long before there is any danger of stranding. This behavior may be sufficiently constant in a vessel to aid in anticipating the first feeble sheer before the rank sheer overtakes her.

Since a vessel tends to sheer *away* from shoaling water on the first influence, she will indicate it by her movement and *the movement of her rudder in the direction in which the rank sheer may take her.*

Assisting her with the helm and regulation of speed may often *prevent the ranker sheer from overtaking a vessel in the "jaws" of danger.*

In a less appreciable degree the "in and out" propeller currents and propeller pressure exert "canting" influences *against* each other, the result of which, (on the ship's heading), must be learned from actual experience with the vessel.

A sheer may be the combined effect of channel conditions and suction produced by another vessel, augmented by improper maneuvers with the helm and engines. This is then a very complicated condition, and suggests the alternative of slowing and stopping in time, if ample passing distance cannot be allowed. (See *"Allowing Ample Passing Room,"* page 33.)

The preventives against squatting, suction, and sheer, when effective, lie, of course, in allowing ample passing room, the proper use of the helm, and the PROPER REGULATION OF SPEED.

(See *Sheers of Tows,* page 52, and *Speed,* page 17.)

METHOD OF OVERTAKING AND PASSING A VESSEL TO AVOID SQUATTING, SUCTION, AND SHEER.

In most instances if a vessel proceeds cautiously, after having secured an answer, and, under proper speed, passes, allowing ample passing room, not parallel with, but ***on an angle away*** from the vessel, squatting and sheer may be overcome, and suction may be reduced to the minimum. The control of speed will aid in eliminating squatting and give more water. In this method of passing, the ***passing distance should widen.*** In preparing to pass in narrow channels, ***the use of the helm too early or too abruptly invites a sheer.***

HELM ACTION.

Confusion has arisen through misunderstanding of the terms "starboard helm" and "port helm," and the gearing of the helm. The method of directing a ship's head has evolved from the primitive oar in the stern of the small vessel up to the modern steam steering gear. The terms "starboard helm" or "port helm" have, however, not been changed, and relate to the ***movement*** of the oar, as a steering oar in a row boat, or a helm, or tiller, in an ordinary sailing vessel, the rudder always moving toward starboard when the helm, or tiller, moves "to port," and the rudder always moving toward port when the helm, or tiller, moves "to starboard." Thus it developed that the ship would swing as follows: A "port helm" swings the stern to port and (after overcoming the ***kick,*** see page 121) the head slowly follows toward starboard, in increasing momentum; and on a "starboard helm" the stern swings to "starboard", turning the head (after overcoming the kick) slowly to port, in increasing momentum. And so the steering orders "port" and "starboard" became established.

In the large modern vessel the rudder is usually geared by means of a quadrant attached to the rudder stock, similar to the helm, with arms reaching both to starboard and to port, attached to the ends of which is the gearing.

It depends upon the gearing, to which side the top of the steering wheel should be turned. On deep sea vessels, the gearing is so arranged that on an order "port," the top of the wheel is turned toward starboard, the rudder moves to starboard, which carries the stern to port, and the head slowly turns towards starboard in increasing momentum; and on an order "starboard," the top of the wheel is turned toward port, the rudder moves to port, which carries the stern to starboard, and the head slowly turns towards port in increasing momentum. Thus on ocean-going vessels, generally, the action of the quadrant arms in throwing the rudder to port or starboard is identically the same as the helm action in the ordinary ship, but, in turning the wheel, the top of the wheel is turned contrary to the way the helm itself would be operated. ***But the habit is easily developed since the top of the wheel is turned in the direction the vessel is intended to go.***

Where the gearings are the reverse of the above, on the order "port," the top of the wheel is turned toward port, the rudder is thrown to starboard, and the vessel's head goes to starboard; under an order "starboard" the top of the wheel is turned toward starboard, the rudder is thrown to port, and the vessel's head goes to port. This is exactly contrary to deep sea gearing, and occurs generally with vessels confined to navigating inland waters, bays, rivers, and their tributaries.

(In speaking of the head going off under helm action, it is after the popular conception—the fact is ***the stern,*** not the head, ***goes off in turning.)***

It will thus be seen that there is danger, and very great danger, of much confusion, and a constant tendency

toward serious mishaps when the helmsman or quartermaster steers a vessel without a thorough understanding of the wheel and helm action. It frequently occurs that habits acquired with gearing of one description are applied automatically, in moments of extreme tension, to gearing of the opposite character, thus leading to action contrary to the steering orders.

It therefore cannot be too strongly impressed upon masters, mates, quartermasters, or wheelmen, new to a vessel, to familiarize themselves with the new conditions.

Owing to the great danger of misapplication of steering orders the only safe method is for the navigating officer to SEE that the steering order is properly obeyed.

THE KICK.

The influence of the helm causes a movement away from the direction a vessel will shortly take in obedience to her helm, i. e., the vessel will first bodily move to port on a hard a port helm and then turn to starboard with increasing momentum, and vice-versa. Some authorities say this influence is exerted for more than two ship's length in her "advance." This tendency to at first resist her helm is termed the "kick," and requires prompt execution of maneuvers, when the vessels are some distance away, if they are to be effectual in avoiding collision.

There is also such a tendency when the engines are suddenly reversed from full speed ahead to full speed astern. In a right hand propeller the "kick" is to port until she takes her "cant" to starboard and the reverse is true of a left hand propeller.

The "kick" is also influenced by some of the interferences named on page 88. The wind and current are prominent interfering factors.

Navigators of skill and experience set these two forces, viz: the "kick" caused by the propeller and the "kick" caused by the helm against each other, and neutralize the tendency to swing away from the direction they intend the vessel shall go. The kick of the helm may also be used to overcome the tendency to "cant" to starboard with right hand wheels or to port with left hand wheels. The remedial helm action here referred to is a quick sharp "hard over" helm, eased in time to catch the transfer in the proper direction. Experiments and experience in the maneuvers of contemporaneous action with reversed engines and helm action will well pay for the trouble, and may aid greatly in close positions. (See *Ship's Record in Turning, Stopping, and Backing,* page 124.) These "kicks" are so pronounced, and affect a vessel for such an appreciable distance and time, that it is dangerous to be too quick or too abrupt in the maneuvers in narrow channels, and close quarters.

In "kicks" and "cants" it is the stern that swings, and the vessel may side step bodily away from the direction her head appears to go. By observing a mark close by, it will be seen her head turns toward it, but the distance from it is apparently increased.

(See *Navigation in Crowded Waters,* page 70. Also see *"Modern Seamanship"* by Knight, *"Avoidance of Collisions at Sea"* by Bainbridge-Hoff, and *"Luce's Seamanship,"* revised by Ward.)

THE ADVANCE.

A vessel does not exactly follow the course shown by the compass when her head is altered. All vessels *advance* while they are gathering their direction in the *transfer.* In the early stages the advance is greater than the transfer and diminishes as the transfer increases, i. e., at first the advance is great and gradually diminishes, while the transfer is feeble, gradually increasing, after the *"kick"* has been overcome. Reduction of speed helps to kill the extent of the advance, and increases the transfer in the first stages. The advance is also influenced by the interferences named on page 88. Wind, current and sea are prominent disturbing factors.

It is possible under the combined effect of the "kick" and "advance" that vessels meeting head and head may have stern "swipes", though they put their helms hard over fully a quarter of a mile away.

As to the *"kick"* and the *"advance"* see *"Modern Seamanship,"* by Knight; *"Avoidance of Collision at Sea,"* by Bainbridge-Hoff, and *"Luce's Seamanship,"* revised by Ward.

TACTICAL MANEUVERS OF VESSELS.

Much has been written on tactical maneuvers based on helm action and sail and engine influence, independently applied, or applied in combination, but the writer has purposely avoided this subject; *first,* because this is intended to be a short topical arrangement of only the most essential and obvious precautions and aids; *second,* it must be assumed that a competent master, navigator, or mate holding a government license, or who has had sufficient practical training to become a master or mate of any vessel, has worked out these problems; *third,* no two vessels handle exactly alike; *fourth,* the principal object of this manual is to stimulate a desire, in both vessels within the "risk" zone, to take *prompt* precautions to avoid the close, and always questionable tactical maneuvers, when in the "jaws" of the danger. (See *Positions One and Two,* page 11.)

The basis of this knowledge lies in *experience* and not in precept. Only the behavior which may be said to be reasonably constant in all vessels has been referred to herein. Positions requiring close and rapid calculations should be avoided when practicable. In close positions—*maneuver slowly.*

If the leading facts and probabilities involved in a collision are carefully weighed, it will usually be seen that *close tactical maneuvers were made necessary by faults committed by*

one or both vessels sometime prior to the last maneuvers, **and to which the collision may properly be laid.**

If fuller treatment is desired this point may be found interestingly presented in *"Modern Seamanship,"* by Capt. Austin M. Knight, U. S. N.; *"Know Your Own Ship,"* by Walton; *"Dangers of the Modern Rule of the Road at Sea and the Maneuvering Powers of Ships As Affecting Collision,"* by Colomb; *"The Avoidance of Collision at Sea,"* by Bainbridge-Hoff, and *"Luce's Seamanship,"* revised by Ward.

THE SHIP'S RECORD IN TURNING, STOPPING, AND BACKING.

The well informed navigator is acquainted with the behavior of his vessel under helm, engine, or sail influence, just as one on land desires, for his own safety, to be informed of the peculiar qualities of the horse he drives. What careful driver, who intends to drive close to a railroad, but instinctively ascertains whether the horse is afraid of the cars?

It is well to become very familiar with the handling of the particular vessel, since this knowledge has an important bearing on tactical maneuvers at close range, and illustrates the necessity to apply precautions, particularly as to helm action and speed, *before* the "kick", "cant", "advance", "suction", and "sheer", complicated by wind, current, and sea, can defeat the maneuvers.

As the maneuvering qualities of a vessel depend upon the particular vessel and surrounding conditions, actual experiments with the vessel are the only safe guide.

Each vessel should be tried out on turning the two, four, six, eight, and sixteen points to starboard or to port, under different degrees of helm, and at different speeds; also carefully noting the effect of the "kick" and the "advance" under different helm action, speeds, and reversing; the time to dead stop from full speed and half speed ahead with engine full

speed and half speed reversed; the extent and character of her "cant" under different maneuvers, noting the effect of the "kick"; the effect of both starboard and port helm when reversing; and the tactical maneuvers with engines at different speeds under port and starboard helm, to get the quickest results in close places. These results should be tabulated and preserved in the ship's records, but each navigator should test them for accuracy.

"Know Your Own Ship," by Walton, is a most appropriate subject for study.

CLOCKS AND CHRONOMETERS.

In addition to the deck and engine room clocks or chronometers, the Captain's room should be provided with the testing clock or chronometer, since one clock or chronometer cannot be tested against another. Periodic tests should be made and differences noted on error card.

Clocks and chronometers are influenced by the same magnetic conditions of ship, cargo, and location that affect the compasses, and they should be carefully inspected and corrected.

An irregular clock or chronometer may upset the best calculations when "running on time," or in taking observations.

Difference in time, between the pilot house and engine room clocks, leads to much doubt in establishing the period when orders were given, or when a collision occurred.

In reading time be sure to stand directly in front of the dial, otherwise serious error may result in short distance runs.

THE RUDDER TELL-TALE.

While the rudder tell-tale is intended to furnish correct information of the movements of the rudder, it may prove wholly deceptive. It is usually geared with a compensating bolt intended to hold it fast after being set. Instances have been known where the tell-tale has been twisted on its bearing. It seems needless to add that the tell-tale is not an altogether reliable method for determining how far the rudder has gone over, nor is the tell-tale bell, which may have the same defect existing in the tell-tale. *An order to "hard a-starboard" or "hard a-port," means give her all you can and be quick about it, and the wheel should be thrown over as far as it will go,* regardless of the tell-tale, or the tell-tale bell. Where a vessel's engines are thus liable to injury arrangements should be made to prevent it.

THE RUNNING LIGHTS' TELL-TALE.

This, as with all automatic attachments, should be supplemented by periodic examination (at half hour bells) of the lights by both the lookout and deck policeman.

THE TELL-TALE COMPASS.

(See *Compass,* page 98.)

AUTOMATIC FOGHORN SOUNDERS.

As with all automatic arrangements, they should be carefully watched in operation.

CHARTS, TIDE TABLES, LIGHTS AND BUOY RECORDS, NOTICES AND BULLETINS TO MARINERS, ETC.

(See Note opposite page 1.)

Private charts can be safely employed only in testing and aiding in the use of Government charts and harbor charts. Vessels not supplied with the latest issues of the official charts, tide tables, lights and buoy records, notices and bulletins to mariners, etc., and which are not kept corrected by posting current official corrections, conveniently located, freely used, and understood, are charged with fault, where the omission of these duties is material.

SHIP'S PAPERS AND RECORDS.

The custom of some masters in removing all the ship's papers and records, when they take command of another vessel, cannot be too vigorously condemned. Each vessel should have all its own papers and records carefully preserved with the ship's name inscribed thereon, and left aboard. They are a part of the vessel's equipment, and are often urgently needed by succeeding masters.

All important rules, regulations, records, and written information should be signed by those who may be called to account for their violation.

PILOT HOUSE.

The presence of anyone in the pilot house other than the regular watch invites confusion, and such presence, though silent, disturbs the regular order of things. Proper concentration is prevented, and confusion is cumulative under these conditions. The very worst condition is brought about through such interference by owners, or by other officers.

WATCHES.

The deck watches are divided into 4-hour periods.

The starboard watch is the Captain's watch (with the second officer when so equipped). The port watch is the First Mate's watch. The prudent commander, however, will be so situated that he is convenient to call at any hour, and, in nasty weather, in crowded waters, or in places where navigation is difficult, he will always assume command.

The watches should be so arranged that the Captain may assume command in all dangerous places, or be called at such places, or when danger threatens; and *the Captain's daily order book should contain all necessary orders.* (See page 130.)

The period during which watches change is fraught with danger. The retiring officer should not leave the pilot-house until at least five to ten minutes after his relief has entered. During this time the conditions should be fully explained, particularly the behavior of the vessel, outside interfering conditions, any noticed deviation from the courses run, log defects, lead records, and any tardiness in attention in the engine room, or deck watches.

Collisions have been traced to the confusion and lack of proper understanding of conditions where a commanding officer has taken charge (in a dazed condition) immediately after he has been awakened.

Dog watch.—The time from 4.00 P. M. to 8.00 P. M. is usually divided into two "dog watches", of two hours each, called the "first dog watch" and the "second dog watch". This alternates the watches daily, and affords opportunity for relief from constant night work.

Deck policeman.—The deck policeman (or watchman) should be a close observer of all internal conditions and the running lights, and should report the lights and all internal matters at least every half hour, (at the time the bells are struck), or *at once, if irregular,* to the officer in charge in the pilot-house. When things are "ship shape" his report is "all's well below, sir."

BEARINGS.

To be at all accurate, bearings must be taken from *amidships.* A light or object, directly ahead or astern, will appear considerably on the bow or quarter of the side from which a bearing is taken when standing on either side of the keel line. Angle observations are likewise dangerous in reading the compass, or a bearing plate, or in taking time from a clock or chronometer. For correct reading, the correct rose point or dial mark must necessarily be directly in line with the needle or hand, and the eye of the observer. (See *Navigation in Crowded Waters,* page 71; *Clocks and Chronometers,* page 125; *The Compass,* page 98.)

REPETITION OF ORDERS AND REPORTS.

Repetition of orders or reports is recommended by all cautious navigators. When the navigating officer orders "South South East" and the quartermaster repeats the order "South South East, Sir," and again on its execution, "now steering South South East, Sir," it serves two purposes:

First: To show that the quartermaster understood the order.

Second: In repeating the order, the navigating officer will hear it in time to correct it, if the order is given in error.

But in all instances the navigating officer should, when practicable, look to see that the quartermaster has obeyed the order.

Every fifteen minutes or oftener, the quartermaster or helmsman should "sing out" the compass direction he is steering. This serves to break the monotony, keeps the commanding officer informed, rivets the quartermaster's or helmsman's attention to his duties and may thwart a "cat" nap. ***But the commanding officer should invariably see, by observing the compass himself, that the report is correct.***

Repetition of the report of the lookout is also prudent. The usual method is to answer the lookout with an electric bell, and ***the lookout should be instructed to report until he*** *receives the answer. The report of the lookout should be repeated by some one in the pilot-house.* In this way the report gets home to all interested.

Repetition of orders to the engine room is also prudent, and to prevent misunderstanding the answer should always be returned and noticed in the pilot-house.

CAPTAIN'S DAILY ORDER BOOK.

This is a most important aid to prevent misunderstanding.

Before retiring the Captain leaves instructions when he is to be called, or what is to be done at particular points on the voyage. These *orders, and other necessary prudential reminders, should be written out, and not left to memory,* or possible misunderstanding. They should be *signed by the Captain, and by each officer* taking the watch, as evidence that they have been given, read and understood. A permanent record is thus established, enabling those on watch, and at changes in the watch, to consult it.

Remember the lead.

THE DECK AND ENGINE ROOM NARRATIVE LOGS.

Great care should be exercised by the officers in charge of these records to see that the exact facts are recorded, and, in the transcription from scrap logs or slates, very great accuracy is required so there may be no necessity to erase or interline matter. If a mistake has been made in transcription it is better to make the correct entry by a note at the end of the narrative explaining the error, rather than to rub or blur out the error. Decisions fixing fault have turned on a badly kept log, and such erasures, or blurs, have been interpreted as an effort to make a false entry. Great care should be used in setting down the sequence of orders, and in setting down time, especially in engine rooms, where time is recorded as of the nearest minute, and fractions of minutes are ignored.

ANTICIPATING OTHER VESSELS' MOVEMENTS.

A large number of collisions are due to a failure to anticipate what the other vessel may do. A navigator should always endeavor to have control over the movements of his vessel and be prepared for an ***unexpected*** maneuver of the other vessel. It is true the presumption is that the other vessel will obey the rule, but due caution requires, ***when practicable,*** that one's vessel shall not be so beyond control, that maneuvers cannot be executed, by a departure from the rules, in an effort to aid in avoiding the fault of the other vessel. But, it should be observed, a vessel which has steadily complied with the rules may not be held in fault if its effort to avoid collision is not successful, though it may be at fault if it does not aid, even by a departure from the rules, when practicable, before the collision becomes inevitable.

(See ***Fourth Position,*** page 13, also ***Departure from the Rules,*** page 40, and ***Error in Extremis,*** page 42.)

INSPECTION OF HULL AND EQUIPMENT

Careful periodic and careful voyage inspection of the vessel, its engines, machinery, tackle, and other equipment may be regarded essential to protect owners against the charge of having "***privity or knowledge***" of defects. This is necessary to detect "***unseaworthiness.***" None of the great protective statutes, such as the Act Limiting Liability, Exemption Against Fire at Sea, the Harter Act, etc., are available, as a defense, where owners have been guilty of a neglect which proper inspection would have prevented. ***For their own protection, owners should see personally to this most important point.***

The covenant that the vessel is seaworthy, which is a part of every insurance policy, charter party, bill of lading, or marine contract, whether expressed therein or not, demands careful inspection of the vessel, and all of its parts and equipment, to protect owners.

Care should, of course, always be exercised by owners in seeing that a vessel is fully supplied with all the aids and equipments required under the Government inspection laws (or required by ordinary prudence or good seamanship) for the protection and preservation of life and property, and they should be kept in good and efficient condition, tested frequently, and conveniently located for instant use; otherwise owners may have a personal liability for damages, which the above-named statutes were intended to remove. Indeed this neglect may be so gross as to involve criminal prosecution against any offender for injury resulting in death. (See *Negligence*, page 2; and *Manning and Equipment*, page 5.)

INSTRUCTIONS TO SUBORDINATE OFFICERS.

A generous attitude toward subordinate officers in imparting knowledge secured through long experience will endear a master or mate, a chief or assistant, to them, and he can feel that his precept and example may be guiding influences toward much good.

ENGINE ROOM WATCH.

True discipline on shipboard, of course, requires close cooperation between the engine room and the deck. On well appointed vessels the most pleasant relations exist between the deck and engine room watches. Unfortunately on some vessels there is constant friction. The great responsibilities of each should induce mutual respect for the other, and leave no room for discord. While the deck watch is charged with great responsibility, the care and attention required in the engine room is scarcely less important. The location of the engine room watch, removed from the interesting field of observation, requires men of great patience, fortitude, courage, and constant faithfulness to duty, to be constantly on the alert to respond to the signals to the engine room. Their position is the most trying and dangerous on shipboard. Upon their promptness in executing emergency orders usually depends the success or failure of the maneuver.

Wherever practicable, the most approved system of communication between the pilot house and engine room, supplemented by back checks, should be adopted, in preference to other less reliable systems.

Anyone forgetful of the great responsibilities of the engine room watch, may profitably ponder *"McAndrew's Hymn"* by Kipling.

(See *Repetition of Orders,* page 129.)

THE FOUR L'S—THE MARINER'S CREED.

By Thomas Gray, C. B.

The following has much in it to assist in avoiding collision:

"I understand L. L. L. L. to be the symbol or sign for four things which I must never neglect; and these things are: Lead, Log, Latitude and Lookout.

"Therefore, I say, use the Lead and the Log; and mind the Latitude and the Lookout.

"I believe in the Lead, as it warns me against dangers which the eye cannot see.

"I believe in the Log, as it checks my distance run.

"I believe in ascertaining the Latitude, as it helps to define my position.

"I believe in the Lookout, as it warns me against dangers to be seen.

"The Lead warns me against dangers invisible, the Log warns me against false distances, the Latitude helps to define my position, and the Lookout warns me against dangers visible.

"And I earnestly resolve, and openly declare, that as I hope to sail my ship in safety on the ocean, as I wish to spare the lives of my fellow-creatures at sea, and as I wish to go in safety all my days, so will I steadfastly practice that which I believe.

"And I hereby warn seamen, and tell them that if they neglect any one of these four things, either the Lead, the Log, the Latitude, or the Lookout, they or their fellows will some day surely perish."

NOTE.—An additional L of value might be added as follows:

I believe in seeing to it myself that my Lights are of proper size and visibility, all kept in good order and properly located, lighted and watched, for I should not neglect what I demand of others.

NAUTICAL MEASURES

The circumference of the earth is divided into 360 degrees, each degree containing 60 nautical miles, or knots; consequently the circumference of the earth (equatorial), 131,385,456 feet, divided by 21,600 (360 × 60) gives the length of a knot, viz: 6,082.66 feet.

One sea mile or British Admiralty knot=6,080 feet, or about 1,014 fathoms, or 1.1515 land or statute mile, or 1,852 kilometer. The knot, or nautical mile, adopted by the United States of America, is 6080.27 feet.

One fathom = 6 feet.

One cable length = one-tenth of a sea mile—about 600 feet or 100 fathoms.

APPENDIX.

BIBLIOGRAPHY.

Containing the Names and Authors of Reference Works on All Branches of Marine Service. These May Be Secured (if in print) Through the Publishers of This Volume.

NOTE.—If any publication or authority has been omitted, notice to the publisher will secure mention in succeeding issues.

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